

STATE OF OHIO  
Richard F. Celeste, Governor  
DEPARTMENT OF NATURAL RESOURCES  
Joseph J. Sommer, Director  
DIVISION OF GEOLOGICAL SURVEY

Information Circular No. 55

## **ANALYSES OF OHIO COALS, 1982-1984**

by  
George Botoman  
and  
David A. Stith

Columbus  
1988



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## ABSTRACT

Standard coal analyses and 72 major, minor, and trace element analyses are reported for 109 coal samples collected from 1982 to 1984. An additional 16 samples have been analyzed for major, minor, and trace elements only.

## INTRODUCTION

Since 1975, the Ohio Department of Natural Resources, Division of Geological Survey (DGS) has been participating with the U.S. Geological Survey (USGS) in an informal cooperative program to expand the available information on the geochemistry of Ohio coals. This report is the fourth in the series presenting the results of this program (Botoman and Stith, 1979, 1981, 1986). Samples covered in this report include channel samples collected from active strip mines in 1983 as well as cores drilled for other DGS investigations, including a regional study of the Clarion (No. 4A) coal in southern Ohio and county studies of Belmont and Guernsey Counties. The samples were collected by personnel of the Ohio Division of Geological Survey and were shipped to the U.S. Geological Survey, whose personnel prepared splits of the samples for the various analytical procedures involved. Major, minor, and trace element analyses were done by the Branch of Analytical Chemistry, U.S. Geological Survey. Twenty-six samples from Guernsey County were shipped directly to a commercial testing lab for processing, including sending splits to the USGS.

Coal samples analyzed by the USGS are included in the National Coal Resources Data System (NCRDS). USGS sample numbers corresponding to the DGS coal file numbers are shown in table 1.

## ANALYTICAL METHODS

The analytical procedure followed for these samples is shown in figure 1. Although the U.S. Geological Survey constantly upgrades and revises its analytical program, this procedure and the one followed for the 1979-1980 samples (Botoman and Stith, 1986) are virtually identical. Thallium (Tl) analysis is again by emission spectrography on ash

rather than neutron activation on whole coal. All standard coal analyses are now done by a commercial testing lab using standard U.S. Bureau of Mines methods (Office of Coal Research, 1967) or comparable ASTM methods.

Approximately one-third of the samples had proximate-ultimate analyses run one to four months after sampling and within one month of being submitted for analysis. These samples were stored in a freezer between core sampling and shipment for analysis. Most of the rest of the samples were stored at room temperature for up to one year. These samples may have been partially oxidized. In addition, 16 of the 1983 strip-mine samples (table 2) were not submitted for proximate-ultimate analysis; these samples were analyzed for major, minor, and trace elements only.

## ACKNOWLEDGMENTS

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The authors also thank numerous members of the staff of the Ohio Division of Geological Survey. Core samples included in this report came from projects by Douglas L. Crowell, Richard M. DeLong, and Clark L. Scheerens. Core drilling was done by Roy T. Dawson, Carl L. Hopfinger, Michael J. Mitchell, and John L. Sullivan.

Finally, appreciation is expressed to the owners and operators whose mines were sampled in this program and to the landowners of the coring sites for allowing the DGS to drill on their property.

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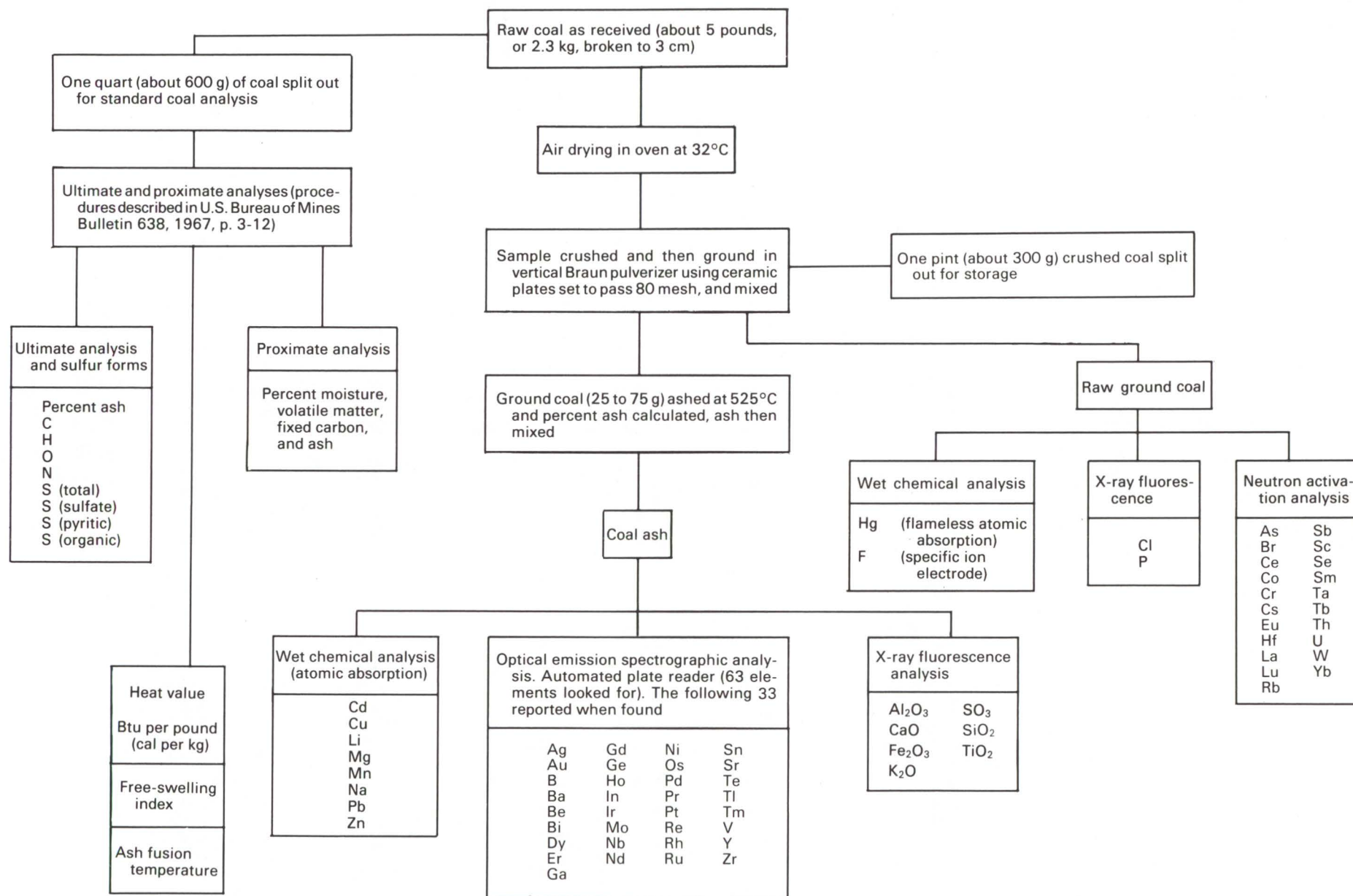


FIGURE 1.—Flow chart showing sequence of sample preparation and chemical analysis (Charles Oman, verbal commun., 1985; Linda Bragg, verbal commun., 1987).

TABLE 1.—U.S. Geological Survey (USGS) sample numbers corresponding to Ohio Division of Geological Survey (DGS) sample numbers

| DGS<br>sample no. | USGS<br>sample no. | DGS<br>sample no. | USGS<br>sample no. | DGS<br>sample no. | USGS<br>sample no. | DGS<br>sample no. | USGS<br>sample no. |
|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|
| 1001              | W217582            | 1416              | W223546            | 1444              | W223457            | 1475              | W224444            |
| 1002              | W217583            | 1417              | W223547            | 1445              | W223458            | 1476              | W224445            |
| 1003              | W217584            | 1418              | W223548            | 1446              | W223459            | 1477              | W225523            |
| 1004              | W217585            | 1419              | W223440            | 1447              | W223460            | 1478              | W225524            |
| 1005              | W217586            | 1420              | W223441            | 1448              | W224350            | 1479              | W225525            |
| 1006              | W217587            | 1421              | W223442            | 1449              | W224351            | 1480              | W226363            |
| 1007              | W217588            | 1422              | W223549            | 1450              | W224326            | 1481              | W226364            |
| 1008              | W217589            | 1423              | W223550            | 1451              | W224327            | 1482              | W226365            |
| 1009              | W217590            | 1424              | W223443            | 1452              | W224328            | 1483              | W226366            |
| 1010              | W217591            | 1424-1            | W223444            | 1453              | W224329            | 1484              | W226367            |
| 1359              | W219407            | 1424-2            | W223445            | 1454              | W224330            | 1485              | W226368            |
| 1386              | W223461            | 1425              | W223551            | 1455              | W224331            | 1486              | W226369            |
| 1396              | W219408            | 1426              | W223446            | 1456              | W224332            | 1487              | W226370            |
| 1397              | W219409            | 1427              | W223447            | 1457              | W224333            | 1488              | W226371            |
| 1398              | W219410            | 1428              | W223448            | 1458              | W224334            | 1489              | W226372            |
| 1399              | W219411            | 1429              | W223449            | 1459              | W224335            | 1490              | W226373            |
| 1400              | W219412            | 1430              | W223450            | 1460              | W224336            | 1491              | W226374            |
| 1401              | W219971            | 1430-1            | W223451            | 1461              | W224337            | 1492              | W227087            |
| 1402              | W219413            | 1431              | W223452            | 1462              | W224338            | 1493              | W227088            |
| 1403              | W219414            | 1432              | W223552            | 1463              | W224339            | 1494              | W227089            |
| 1404              | W219415            | 1433              | W223553            | 1464              | W224340            | 1495              | W227090            |
| 1405              | W219416            | 1434              | W223554            | 1465              | W224341            | 1496              | W227091            |
| 1406              | W220797            | 1435              | W223453            | 1466              | W224342            | 1497              | W227092            |
| 1407              | W220798            | 1436              | W223555            | 1467              | W224343            | 1498              | W227093            |
| 1408              | W220799            | 1437              | W223556            | 1468              | W224344            | 1499              | W227094            |
| 1409              | W220800            | 1438              | W223454            | 1469              | W224345            | 1500              | W227095            |
| 1410              | W220801            | 1439              | W223455            | 1470              | W224346            | 1502              | W229480            |
| 1411              | W223541            | 1440              | W223557            | 1471              | W224347            | 1503              | W229481            |
| 1412              | W223542            | 1441              | W223558            | 1472              | W224348            | 1504              | W229482            |
| 1413              | W223543            | 1442              | W223559            | 1473              | W224349            | 1505              | W229483            |
| 1414              | W223544            | 1443              | W223456            | 1474              | W224443            | 1506              | W229484            |
| 1415              | W223545            |                   |                    |                   |                    |                   |                    |

TABLE 2.—1983 samples not submitted for standard coal analyses

| DGS<br>file<br>no. | County     | Township    | Seam                      | Thickness<br>(inches) |
|--------------------|------------|-------------|---------------------------|-----------------------|
| 1417               | Stark      | Pike        | Lower Kittanning (No. 5)  | 36                    |
| 1419               | Stark      | Osnaburg    | Lower Kittanning (No. 5)  | 40                    |
| 1420               | Stark      | Osnaburg    | Middle Kittanning (No. 6) | 41                    |
| 1422               | Stark      | Sugar Creek | Middle Kittanning (No. 6) | 28                    |
| 1423               | Stark      | Paris       | Middle Kittanning (No. 6) | 26                    |
| 1424               | Stark      | Sandy       | Brookville (No. 4)        | 26                    |
| 1424-1             | Stark      | Sandy       | Brookville (No. 4)        | 4                     |
| 1424-2             | Stark      | Sandy       | Brookville (No. 4)        | 8                     |
| 1425               | Columbiana | West        | Upper Freeport (No. 7)    | 52                    |
| 1433               | Stark      | Paris       | Lower Kittanning (No. 5)  | 24                    |
| 1435               | Columbiana | Franklin    | Mahoning                  | 21                    |
| 1436               | Columbiana | Hanover     | Upper Freeport (No. 7)    | 38                    |
| 1437               | Columbiana | West        | Upper Freeport (No. 7)    | 34                    |
| 1438               | Columbiana | Center      | Mahoning                  | 33                    |
| 1468               | Columbiana | Elk Run     | Upper Freeport (No. 7)    | 30                    |
| 1469               | Columbiana | Elk Run     | Mahoning                  | 28                    |



TABLE 3.—*Proximate-ultimate coal analyses by county*

Key to symbols by column:

Seam:

? - Bed designation tentative

DGS file no.:

4-digit number - production bench or whole-bed channel or core sample; taken in conformity with Holmes, 1911; Fieldner and Selvig, 1938

-1, -2 - samples taken in benches or from roof or floor coal

Kind:

2 - channel (strip mine)

3 - core

Condition:

2 - as received

3 - moisture-free

4 - moisture- and ash-free

Analyzed thickness:

<sup>1</sup> - upper bench<sup>2</sup> - middle bench<sup>3</sup> - sample from pyrite study, crushed to minus 3/8" at DGS before shipment for analysis

| Township | Seam                      | DGS file no. | Kind | Condition | Analyzed thickness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                 |              |      | Ultimate analysis (%) |        |          |        |              |         | Forms of sulfur (%) |         |                                 | Free-swelling index | Fusibility of ash (°F) |                   |        | Heating value (Btu/lb) | Year |
|----------|---------------------------|--------------|------|-----------|---------------------------------|--------------------|------------------------|-----------------|--------------|------|-----------------------|--------|----------|--------|--------------|---------|---------------------|---------|---------------------------------|---------------------|------------------------|-------------------|--------|------------------------|------|
|          |                           |              |      |           |                                 |                    | Moisture               | Volatile matter | Fixed carbon | Ash  | Hydrogen              | Carbon | Nitrogen | Oxygen | Total sulfur | Sulfate | Pyritic             | Organic | Initial deformation temperature |                     | Softening temperature  | Fluid temperature |        |                        |      |
| Goshen   | <b>BELMONT COUNTY</b>     |              |      |           |                                 |                    |                        |                 |              |      |                       |        |          |        |              |         |                     |         |                                 |                     |                        |                   |        |                        |      |
|          | Clarion (No. 4A)          | 1405         | 3    | 2         | 26                              | 1.3                | 2.2                    | 40.7            | 46.3         | 10.7 | 5.4                   | 71.7   | 1.4      | 7.9    | 2.9          | 0.02    | 1.72                | 1.13    | 4.5                             | 2080                | 2190                   | 2380              | 13,060 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 41.7            | 47.4         | 10.9 | 5.3                   | 73.3   | 1.4      | 6.1    | 2.9          | 0.02    | 1.76                | 1.16    |                                 |                     |                        |                   | 13,350 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 46.8            | 53.2         |      | 5.9                   | 82.4   | 1.6      | 6.9    | 3.3          | 0.02    | 1.97                | 1.30    |                                 |                     |                        |                   | 14,990 |                        |      |
|          | Lower Kittanning (No. 5)  | 1404         | 3    | 2         | 35                              | 1.4                | 2.3                    | 41.2            | 47.9         | 8.5  | 5.3                   | 72.5   | 1.4      | 7.3    | 5.0          | 0.03    | 3.02                | 1.95    | 5.0                             | 1920                | 2040                   | 2100              | 13,330 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 42.2            | 49.1         | 8.8  | 5.2                   | 74.2   | 1.4      | 5.4    | 5.1          | 0.03    | 3.09                | 2.00    |                                 |                     |                        |                   | 13,650 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 46.2            | 53.8         |      | 5.7                   | 81.3   | 1.5      | 5.9    | 5.6          | 0.03    | 3.39                | 2.19    |                                 |                     |                        |                   | 14,950 |                        |      |
|          | Middle Kittanning (No. 6) | 1403         | 3    | 2         | 37                              | 1.3                | 1.9                    | 42.1            | 46.8         | 9.2  | 5.4                   | 72.2   | 1.4      | 8.1    | 3.8          | 0.03    | 1.97                | 1.78    | 4.5                             | 1980                | 2080                   | 2150              | 13,220 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 43.0            | 47.7         | 9.4  | 5.2                   | 73.6   | 1.4      | 6.6    | 3.9          | 0.03    | 2.01                | 1.81    |                                 |                     |                        |                   | 13,470 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 47.4            | 52.6         |      | 5.8                   | 81.2   | 1.5      | 7.3    | 4.3          | 0.03    | 2.22                | 2.00    |                                 |                     |                        |                   | 14,860 |                        |      |
|          | Anderson                  | 1402         | 3    | 2         | 20                              | 1.3                | 2.3                    | 38.8            | 44.2         | 14.7 | 4.9                   | 66.7   | 1.3      | 7.0    | 5.4          | 0.06    | 3.46                | 1.89    | 5.0                             | 1910                | 1990                   | 2030              | 12,220 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 39.7            | 45.2         | 15.1 | 4.7                   | 68.3   | 1.3      | 5.1    | 5.5          | 0.06    | 3.54                | 1.93    |                                 |                     |                        |                   | 12,510 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 46.8            | 53.2         |      | 5.6                   | 80.4   | 1.5      | 6.0    | 6.5          | 0.07    | 4.17                | 2.28    |                                 |                     |                        |                   | 14,730 |                        |      |
|          | Pittsburgh (No. 8)        | 1401         | 3    | 2         | 80                              | 0.7                | 2.0                    | 40.6            | 45.7         | 11.7 | 5.2                   | 69.4   | 1.3      | 7.6    | 4.8          | 0.05    | 2.90                | 1.86    | 5.5                             | 1970                | 2060                   | 2350              | 12,750 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 41.5            | 46.6         | 11.9 | 5.1                   | 70.8   | 1.3      | 5.9    | 4.9          | 0.05    | 2.96                | 1.90    |                                 |                     |                        |                   | 13,010 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 47.1            | 52.9         |      | 5.8                   | 80.4   | 1.5      | 6.7    | 5.6          | 0.06    | 3.36                | 2.16    |                                 |                     |                        |                   | 14,780 |                        |      |
|          | Meigs Creek (No. 9)       | 1400         | 3    | 2         | 47                              | 1.8                | 2.8                    | 38.2            | 43.2         | 15.8 | 4.8                   | 65.8   | 1.2      | 8.0    | 4.3          | 0.01    | 2.35                | 1.94    | 5.0                             | 2000                | 2060                   | 2100              | 11,860 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 39.3            | 44.5         | 16.2 | 4.6                   | 67.7   | 1.3      | 5.7    | 4.4          | 0.01    | 2.42                | 2.00    |                                 |                     |                        |                   | 12,200 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 46.9            | 53.1         |      | 5.5                   | 80.8   | 1.5      | 6.8    | 5.3          | 0.01    | 2.89                | 2.38    |                                 |                     |                        |                   | 14,560 |                        |      |
| Kirkwood | Quakertown (No. 2)?       | 1409         | 3    | 2         | 21                              | 1.4                | 2.5                    | 35.5            | 47.8         | 14.3 | 5.1                   | 68.2   | 1.2      | 9.3    | 1.9          | 0.03    | 1.18                | 0.65    | 4.5                             | 2560                | 2670                   | 2730              | 12,310 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 36.4            | 49.0         | 14.6 | 5.0                   | 70.0   | 1.2      | 7.3    | 1.9          | 0.03    | 1.21                | 0.67    |                                 |                     |                        |                   | 12,620 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 42.6            | 57.4         |      | 5.8                   | 82.0   | 1.4      | 8.6    | 2.2          | 0.04    | 1.42                | 0.78    |                                 |                     |                        |                   | 14,790 |                        |      |
|          |                           | 1431         | 3    | 2         | 23                              | 0.3                | 1.6                    | 38.3            | 50.7         | 9.3  | 5.3                   | 73.4   | 1.2      | 8.4    | 2.4          | 0.02    | 1.52                | 0.86    | 4.5                             | 2130                | 2380                   | 2420              | 13,190 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 39.0            | 51.6         | 9.4  | 5.2                   | 74.7   | 1.3      | 7.0    | 2.4          | 0.02    | 1.55                | 0.87    |                                 |                     |                        |                   | 13,410 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 43.0            | 57.0         |      | 5.7                   | 82.4   | 1.4      | 7.8    | 2.7          | 0.02    | 1.71                | 0.97    |                                 |                     |                        |                   | 14,810 |                        |      |
|          | Clarion (No. 4A)          | 1408         | 3    | 2         | 20                              | 1.1                | 2.2                    | 36.7            | 42.7         | 18.3 | 4.9                   | 63.7   | 1.1      | 8.3    | 3.6          | 0.08    | 2.18                | 1.30    | 5.5                             | 2190                | 2340                   | 2580              | 11,650 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 37.6            | 43.7         | 18.8 | 4.8                   | 65.2   | 1.2      | 6.5    | 3.6          | 0.08    | 2.23                | 1.33    |                                 |                     |                        |                   | 11,910 |                        |      |
|          |                           |              |      | 4         |                                 |                    |                        | 46.3            | 53.7         |      | 5.9                   | 80.2   | 1.4      | 8.0    | 4.5          | 0.10    | 2.74                | 1.64    |                                 |                     |                        |                   | 14,660 |                        |      |
|          |                           | 1430         | 3    | 2         | 24 <sup>1</sup>                 | 0.4                | 2.0                    | 38.4            | 41.7         | 17.9 | 4.9                   | 65.1   | 1.2      | 8.9    | 2.0          | 0.01    | 0.62                | 1.39    | 5.5                             | 2710                | 2800                   | 2800              | 11,820 | 83                     |      |
|          |                           |              |      | 3         |                                 |                    |                        | 39.2            | 42.5         | 18.3 | 4.8                   | 66.5   | 1.2      | 7.2    | 2.1          | 0.01    | 0.63                | 1.42    |                                 |                     |                        |                   |        |                        |      |

|          |                           |        |   |             |                 |     |     |                      |                      |              |                   |                      |                   |                    |                   |                      |                      |                      |     |      |      |      |                            |    |
|----------|---------------------------|--------|---|-------------|-----------------|-----|-----|----------------------|----------------------|--------------|-------------------|----------------------|-------------------|--------------------|-------------------|----------------------|----------------------|----------------------|-----|------|------|------|----------------------------|----|
| Richland | Lower Kittanning (No. 5)  | 1430-1 | 3 | 2<br>3<br>4 | 12 <sup>2</sup> | 0.2 | 1.3 | 24.0<br>24.3<br>48.6 | 25.4<br>25.7<br>51.4 | 49.4<br>50.0 | 3.1<br>3.0<br>6.0 | 37.7<br>38.2<br>76.4 | 0.7<br>0.7<br>1.5 | 7.2<br>6.2<br>12.4 | 1.9<br>1.9<br>3.8 | 0.01<br>0.01<br>0.02 | 1.02<br>1.03<br>2.07 | 0.83<br>0.84<br>1.68 | 1.0 | 2800 | 2800 | 2800 | 6,950<br>7,040<br>14,090   | 83 |
|          |                           | 1397   | 3 | 2<br>3<br>4 | 31              | 1.2 | 2.1 | 40.6<br>41.4<br>47.3 | 45.2<br>46.2<br>52.7 | 12.1<br>12.4 | 5.1<br>5.0<br>5.7 | 68.8<br>70.3<br>80.2 | 1.3<br>1.4<br>1.6 | 7.4<br>5.7<br>6.5  | 5.1<br>5.3<br>6.0 | 0.12<br>0.12<br>0.14 | 3.19<br>3.26<br>3.72 | 1.84<br>1.88<br>2.14 | 4.5 | 1900 | 1990 | 2100 | 12,710<br>12,980<br>14,820 | 82 |
|          |                           | 1407   | 3 | 2<br>3<br>4 | 38              | 1.0 | 2.2 | 40.1<br>41.0<br>47.1 | 45.1<br>46.1<br>52.9 | 12.6<br>12.9 | 5.1<br>5.0<br>5.7 | 68.9<br>70.5<br>80.9 | 1.2<br>1.3<br>1.5 | 7.3<br>5.5<br>6.3  | 4.8<br>4.9<br>5.6 | 0.16<br>0.16<br>0.19 | 2.97<br>3.04<br>3.49 | 1.64<br>1.68<br>1.92 | 3.5 | 1920 | 1960 | 2140 | 12,580<br>12,860<br>14,770 | 83 |
|          |                           | 1429   | 3 | 2<br>3<br>4 | 39              | 0.4 | 1.7 | 33.2<br>33.8<br>47.1 | 37.4<br>38.0<br>52.9 | 27.7<br>28.1 | 4.2<br>4.1<br>5.7 | 57.6<br>58.6<br>81.5 | 1.1<br>1.1<br>1.6 | 6.2<br>4.7<br>6.6  | 3.3<br>3.4<br>4.7 | 0.09<br>0.09<br>0.13 | 1.68<br>1.71<br>2.38 | 1.53<br>1.56<br>2.17 | 4.5 | 2800 | 2800 | 2800 | 10,490<br>10,670<br>14,840 | 83 |
|          | Middle Kittanning (No. 6) | 1398   | 3 | 2<br>3<br>4 | 39              | 1.2 | 1.9 | 38.2<br>39.0<br>49.3 | 39.4<br>40.1<br>50.7 | 20.5<br>20.9 | 4.9<br>4.8<br>6.1 | 62.0<br>63.2<br>79.9 | 1.1<br>1.2<br>1.5 | 7.7<br>6.1<br>7.7  | 3.7<br>3.8<br>4.8 | 0.03<br>0.03<br>0.04 | 2.26<br>2.30<br>2.91 | 1.46<br>1.49<br>1.88 | 4.5 | 2110 | 2250 | 2350 | 11,350<br>11,580<br>14,630 | 82 |
|          |                           | 1406   | 3 | 2<br>3<br>4 | 31              | 1.2 | 2.3 | 35.6<br>36.4<br>47.7 | 39.0<br>39.9<br>52.3 | 23.2<br>23.7 | 4.6<br>4.4<br>5.8 | 59.3<br>60.7<br>79.6 | 1.0<br>1.0<br>1.3 | 7.6<br>5.7<br>7.5  | 4.3<br>4.4<br>5.8 | 0.07<br>0.07<br>0.09 | 2.95<br>3.02<br>3.96 | 1.29<br>1.32<br>1.73 | 4.0 | 2100 | 2190 | 2320 | 10,900<br>11,160<br>14,630 | 83 |
|          |                           | 1428   | 3 | 2<br>3<br>4 | 35              | 0.3 | 1.9 | 40.9<br>41.7<br>46.7 | 46.7<br>47.7<br>53.3 | 10.4<br>10.6 | 5.2<br>5.1<br>5.7 | 70.7<br>72.1<br>80.7 | 1.2<br>1.3<br>1.4 | 8.5<br>6.9<br>7.7  | 3.9<br>4.0<br>4.4 | 0.06<br>0.06<br>0.07 | 2.14<br>2.18<br>2.44 | 1.69<br>1.72<br>1.93 | 5.0 | 2020 | 2120 | 2170 | 12,940<br>13,190<br>14,760 | 83 |
|          |                           | 1399   | 3 | 2<br>3<br>4 | 62              | 1.6 | 2.6 | 37.1<br>38.1<br>44.0 | 47.3<br>48.5<br>56.0 | 13.0<br>13.4 | 5.0<br>4.8<br>5.5 | 68.5<br>70.4<br>81.3 | 1.3<br>1.3<br>1.6 | 8.6<br>6.4<br>7.4  | 3.6<br>3.7<br>4.2 | 0.05<br>0.05<br>0.06 | 2.42<br>2.49<br>2.87 | 1.09<br>1.12<br>1.29 | 5.5 | 2050 | 2140 | 2180 | 12,350<br>12,680<br>14,650 | 82 |
|          | Upper Freeport (No. 7)    | 1427   | 3 | 2<br>3<br>4 | 55              | 0.4 | 1.9 | 33.4<br>34.1<br>43.6 | 43.2<br>44.1<br>56.4 | 21.4<br>21.8 | 4.3<br>4.2<br>5.4 | 60.8<br>62.0<br>79.3 | 1.1<br>1.2<br>1.5 | 8.6<br>7.1<br>9.0  | 3.7<br>3.7<br>4.8 | 0.06<br>0.06<br>0.08 | 2.48<br>2.53<br>3.23 | 1.13<br>1.15<br>1.47 | 5.0 | 2210 | 2340 | 2430 | 11,000<br>11,210<br>14,340 | 83 |
|          |                           | 1396   | 3 | 2<br>3<br>4 | 36              | 1.9 | 2.7 | 34.8<br>35.8<br>45.0 | 42.5<br>43.6<br>55.0 | 20.0<br>20.6 | 4.7<br>4.5<br>5.6 | 62.6<br>64.3<br>81.0 | 1.2<br>1.2<br>1.5 | 8.7<br>6.5<br>8.2  | 2.9<br>2.9<br>3.7 | 0.04<br>0.04<br>0.05 | 1.65<br>1.70<br>2.14 | 1.17<br>1.20<br>1.51 | 4.0 | 2170 | 2300 | 2370 | 11,230<br>11,540<br>14,530 | 82 |
|          |                           | 1410   | 3 | 2<br>3<br>4 | 19              | 1.6 | 2.8 | 37.5<br>38.6<br>43.9 | 47.9<br>49.3<br>56.1 | 11.8<br>12.1 | 5.0<br>4.8<br>5.4 | 69.6<br>71.7<br>81.5 | 1.2<br>1.2<br>1.4 | 9.1<br>6.8<br>7.7  | 3.4<br>3.5<br>4.0 | 0.04<br>0.04<br>0.05 | 1.86<br>1.91<br>2.18 | 1.50<br>1.54<br>1.76 | 5.5 | 2100 | 2250 | 2390 | 12,520<br>12,880<br>14,660 | 83 |
|          |                           | 1426   | 3 | 2<br>3<br>4 | 27              | 0.4 | 1.8 | 36.0<br>36.6<br>45.3 | 43.4<br>44.2<br>54.7 | 18.8<br>19.2 | 4.6<br>4.5<br>5.6 | 63.2<br>64.4<br>79.6 | 1.2<br>1.2<br>1.5 | 7.4<br>5.9<br>7.3  | 4.8<br>4.9<br>6.0 | 0.05<br>0.05<br>0.06 | 2.83<br>2.88<br>3.57 | 1.92<br>1.96<br>2.42 | 3.0 | 2100 | 2190 | 2230 | 11,500<br>11,710<br>14,490 | 83 |
| Richland | Lower Kittanning (No. 5)  | 1447   | 3 | 2<br>3<br>4 | 50              | 0.3 | 1.8 | 39.2<br>39.9<br>43.3 | 51.2<br>52.1<br>56.7 | 7.8<br>8.0   | 5.5<br>5.4<br>5.9 | 75.2<br>76.6<br>83.2 | 1.5<br>1.5<br>1.6 | 8.2<br>6.7<br>7.3  | 1.8<br>1.8<br>2.0 | 0.01<br>0.01<br>0.01 | 1.06<br>1.08<br>1.17 | 0.71<br>0.72<br>0.79 | 5.0 | 2150 | 2440 | 2510 | 13,530<br>13,770<br>14,970 | 83 |
|          |                           | 1443   | 3 | 2<br>3<br>4 | 28              | 0.3 | 1.4 | 40.6<br>41.2<br>48.5 | 43.0<br>43.7<br>51.5 | 14.9<br>15.1 | 5.0<br>4.9<br>5.8 | 67.4<br>68.4<br>80.6 | 1.2<br>1.2<br>1.4 | 6.0<br>4.8<br>5.7  | 5.5<br>5.6<br>6.6 | 0.07<br>0.07<br>0.08 | 3.12<br>3.17<br>3.73 | 2.33<br>2.36<br>2.78 | 4.0 | 2000 | 2090 | 2160 | 12,410<br>12,590<br>14,830 | 83 |
| York     | Brookville (No. 4)        | 1414   | 3 | 2<br>3<br>4 | 46              | 0.2 | 1.4 | 31.7<br>32.1<br>42.3 | 43.2<br>43.9<br>57.7 | 23.7<br>24.0 | 4.4<br>4.3<br>5.6 | 60.9<br>61.7<br>81.2 | 1.2<br>1.2<br>1.6 | 8.0<br>6.8<br>9.0  | 2.0<br>2.0<br>2.6 | 0.02<br>0.02<br>0.03 | 1.04<br>1.05<br>1.39 | 0.90<br>0.91<br>1.20 | 4.0 | 2790 | 2800 | 2800 | 10,940<br>11,100<br>14,610 | 83 |
|          |                           | 1413   | 3 | 2<br>3<br>4 | 36              | 0.2 | 1.8 | 40.3<br>41.0<br>44.9 | 49.5<br>50.4<br>55.1 | 8.5<br>8.6   | 5.3<br>5.2<br>5.7 | 73.9<br>75.2<br>82.3 | 1.4<br>1.4<br>1.6 | 7.8<br>6.3<br>6.9  | 3.2<br>3.2<br>3.6 | 0.06<br>0.06<br>0.07 | 1.54<br>1.57<br>1.72 | 1.59<br>1.62<br>1.77 | 6.0 | 2000 | 2160 | 2220 | 13,380<br>13,610<br>14,900 | 83 |
|          | Upper Freeport (No. 7)    | 1412   | 3 | 2<br>3<br>4 | 21              | 0.3 | 1.6 | 33.2<br>33.7<br>45.5 | 39.8<br>40.5<br>54.5 | 25.4<br>25.8 | 4.2<br>4.1<br>5.5 | 56.9<br>57.8<br>77.9 | 1.1<br>1.1<br>1.5 | 6.4<br>5.1<br>6.9  | 6.0<br>6.1<br>8.2 | 0.19<br>0.19<br>0.26 | 3.29<br>3.34<br>4.51 | 2.54<br>2.58<br>3.48 | 4.5 | 2020 | 2180 | 2230 | 10,470<br>10,640<br>14,340 | 83 |
|          |                           | 1411   | 3 | 2<br>3<br>4 | 18              | 0.2 | 1.9 | 35.6<br>36.3<br>40.6 | 52.2<br>53.2<br>59.4 | 10.2<br>10.4 | 5.1<br>4.9<br>5.5 | 72.5<br>73.9<br>82.5 | 1.5<br>1.5<br>1.7 | 9.8<br>8.2<br>9.2  | 0.9<br>1.0<br>1.1 | 0.02<br>0.02<br>0.02 | 0.15<br>0.15<br>0.17 | 0.77<br>0.78<br>0.88 | 5.0 | 2800 | 2800 | 2800 | 12,910<br>13,160<br>14,690 | 83 |
|          | Not designated            | 1462   | 3 | 2<br>3<br>4 | 22              | 0.3 | 1.5 | 38.0<br>38.6<br>43.8 | 48.8<br>49.6<br>56.2 | 11.6<br>11.8 | 5.2<br>5.1<br>5.8 | 73.7<br>74.8<br>84.8 | 1.2<br>1.3<br>1.4 | 7.1<br>5           |                   |                      |                      |                      |     |      |      |      |                            |    |



| Township          | Seam                   | DGS<br>file<br>no. | Kind | Condition   | Analyzed thick-<br>ness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                      |                      |                     | Ultimate analysis (%) |                      |                   |                    |                   | Forms of sulfur (%)  |                      |                      | Free-swelling<br>index | Fusibility of ash (°F)                |                          |                      | Heating<br>value<br>(Btu/lb) | Year |  |
|-------------------|------------------------|--------------------|------|-------------|--------------------------------------|--------------------|------------------------|----------------------|----------------------|---------------------|-----------------------|----------------------|-------------------|--------------------|-------------------|----------------------|----------------------|----------------------|------------------------|---------------------------------------|--------------------------|----------------------|------------------------------|------|--|
|                   |                        |                    |      |             |                                      |                    | Moisture               | Volatile<br>matter   | Fixed carbon         | Ash                 | Hydrogen              | Carbon               | Nitrogen          | Oxygen             | Total sulfur      | Sulfate              | Pyritic              | Organic              |                        | Initial<br>deformation<br>temperature | Softening<br>temperature | Fluid<br>temperature |                              |      |  |
| CARROLL COUNTY    |                        |                    |      |             |                                      |                    |                        |                      |                      |                     |                       |                      |                   |                    |                   |                      |                      |                      |                        |                                       |                          |                      |                              |      |  |
| Lee               | Harlem                 | 1450               | 2    | 2<br>3<br>4 | 32                                   | 3.4                | 6.3                    | 35.4<br>37.8<br>41.2 | 50.5<br>53.9<br>58.8 | 7.8<br>8.3<br>5.5   | 5.5<br>5.1<br>5.5     | 70.6<br>75.3<br>82.1 | 1.5<br>1.6<br>1.7 | 13.4<br>8.3<br>9.1 | 1.3<br>1.3<br>1.5 | 0.13<br>0.14<br>0.15 | 0.62<br>0.66<br>0.72 | 0.51<br>0.54<br>0.59 | 5.5                    | 2210                                  | 2320                     | 2530                 | 12,560<br>13,400<br>14,620   | 83   |  |
| Rose              | Strasburg (No. 5A)     | 1449               | 2    | 2<br>3<br>4 | 14                                   | 0.6                | 2.5                    | 47.1<br>48.3<br>56.2 | 36.7<br>37.6<br>43.8 | 13.7<br>14.1<br>6.2 | 5.5<br>5.3<br>6.2     | 64.7<br>66.3<br>77.2 | 1.4<br>1.4<br>1.7 | 8.7<br>6.7<br>7.8  | 6.0<br>6.1<br>7.1 | 0.32<br>0.33<br>0.38 | 3.11<br>3.19<br>3.71 | 2.55<br>2.62<br>3.04 | 3.0                    | 1970                                  | 2070                     | 2110                 | 12,140<br>12,450<br>14,490   | 83   |  |
| COLUMBIANA COUNTY |                        |                    |      |             |                                      |                    |                        |                      |                      |                     |                       |                      |                   |                    |                   |                      |                      |                      |                        |                                       |                          |                      |                              |      |  |
| Butler            | Upper Freeport (No. 7) | 1439               | 2    | 2<br>3<br>4 | 50                                   | 1.1                | 3.3                    | 36.6<br>37.8<br>46.9 | 41.4<br>42.8<br>53.1 | 18.8<br>19.4<br>5.6 | 4.7<br>4.5<br>5.6     | 60.9<br>63.0<br>78.1 | 1.2<br>1.2<br>1.5 | 10.1<br>7.4<br>9.2 | 4.4<br>4.5<br>5.6 | 0.26<br>0.27<br>0.33 | 2.34<br>2.42<br>3.00 | 1.76<br>1.82<br>2.26 | 2.5                    | 2100                                  | 2190                     | 2420                 | 11,160<br>11,540<br>14,320   | 83   |  |
| Center            | Mahoning               | 1440               | 2    | 2<br>3<br>4 | 19                                   | 4.0                | 7.1                    | 33.9<br>36.6<br>40.5 | 49.9<br>53.7<br>59.5 | 9.0<br>9.7<br>5.5   | 5.4<br>4.9<br>5.5     | 68.4<br>73.7<br>81.6 | 1.5<br>1.6<br>1.8 | 14.3<br>8.5<br>9.4 | 1.4<br>1.5<br>1.7 | 0.30<br>0.32<br>0.36 | 0.62<br>0.67<br>0.74 | 0.51<br>0.55<br>0.61 | 6.5                    | 2170                                  | 2270                     | 2350                 | 12,150<br>13,090<br>14,490   | 83   |  |
| Elk Run           | Upper Freeport (No. 7) | 1466               | 2    | 2<br>3<br>4 | 36                                   | 3.4                | 5.4                    | 34.3<br>36.3<br>39.2 | 53.2<br>56.3<br>60.8 | 7.0<br>7.4<br>5.3   | 5.2<br>4.9<br>5.3     | 71.7<br>75.8<br>81.9 | 1.3<br>1.4<br>1.5 | 11.8<br>7.4<br>8.0 | 2.9<br>3.1<br>3.3 | 0.18<br>0.19<br>0.21 | 1.52<br>1.61<br>1.74 | 1.20<br>1.27<br>1.37 | 7.5                    | 1990                                  | 2140                     | 2200                 | 12,780<br>13,500<br>14,590   | 83   |  |
|                   | Mahoning               | 1467               | 2    | 2<br>3<br>4 | 21                                   | 2.6                | 4.8                    | 33.2<br>34.9<br>39.5 | 50.8<br>53.3<br>6    |                     |                       |                      |                   |                    |                   |                      |                      |                      |                        |                                       |                          |                      |                              |      |  |

|           |                           |                 |   |             |    |     |     |                      |                      |              |                   |                      |                   |                    |                    |                      |                      |                      |     |      |      |      |                            |    |
|-----------|---------------------------|-----------------|---|-------------|----|-----|-----|----------------------|----------------------|--------------|-------------------|----------------------|-------------------|--------------------|--------------------|----------------------|----------------------|----------------------|-----|------|------|------|----------------------------|----|
| Raccoon   | Clarion (No. 4A)          | 1003            | 3 | 2<br>3<br>4 | 31 | 5.2 | 7.2 | 38.1<br>41.1<br>48.4 | 40.6<br>43.8<br>51.6 | 14.0<br>15.1 | 5.0<br>4.5<br>5.3 | 61.7<br>66.5<br>78.3 | 1.2<br>1.3<br>1.5 | 13.3<br>7.4<br>8.7 | 4.8<br>5.2<br>6.1  | 0.16<br>0.17<br>0.20 | 3.36<br>3.62<br>4.27 | 1.31<br>1.41<br>1.66 | 3.0 | 1950 | 2060 | 2110 | 11,250<br>12,130<br>14,290 | 82 |
|           |                           | 1004            | 3 | 2<br>3<br>4 | 29 | 2.6 | 4.9 | 35.7<br>37.6<br>49.5 | 36.4<br>38.3<br>50.5 | 22.9<br>24.1 | 4.7<br>4.3<br>5.7 | 53.5<br>56.3<br>74.2 | 1.0<br>1.1<br>1.4 | 11.3<br>7.3<br>9.6 | 6.6<br>6.9<br>9.1  | 0.23<br>0.24<br>0.32 | 4.92<br>5.18<br>6.82 | 1.43<br>1.50<br>1.98 | 2.5 | 2100 | 2260 | 2320 | 10,030<br>10,550<br>13,890 | 82 |
|           |                           | GUERNSEY COUNTY |   |             |    |     |     |                      |                      |              |                   |                      |                   |                    |                    |                      |                      |                      |     |      |      |      |                            |    |
| Adams     | Lower Kittanning (No. 5)  | 1486            | 3 | 2<br>3<br>4 | 45 | 2.3 | 4.0 | 41.0<br>42.7<br>52.0 | 37.8<br>39.4<br>48.0 | 17.3<br>18.0 | 5.0<br>4.8<br>5.9 | 60.6<br>63.1<br>77.0 | 1.0<br>1.1<br>1.3 | 8.6<br>5.3<br>6.5  | 7.4<br>7.7<br>9.4  | 0.02<br>0.02<br>0.03 | 4.44<br>4.62<br>5.64 | 2.92<br>3.04<br>3.71 | 2.5 | 2020 | 2150 | 2210 | 11,400<br>11,880<br>14,480 | 84 |
|           | Strasburg (No. 5A)        | 1485            | 3 | 2<br>3<br>4 | 33 | 2.3 | 3.9 | 44.4<br>46.2<br>52.3 | 40.4<br>42.1<br>47.7 | 11.3<br>11.7 | 5.4<br>5.1<br>5.8 | 66.4<br>69.1<br>78.3 | 1.1<br>1.2<br>1.4 | 10.2<br>7.0<br>7.9 | 5.6<br>5.8<br>6.6  | 0.02<br>0.02<br>0.02 | 3.03<br>3.15<br>3.57 | 2.54<br>2.64<br>3.00 | 3.5 | 1950 | 2110 | 2190 | 12,380<br>12,880<br>14,600 | 84 |
|           | Middle Kittanning (No. 6) | 1484            | 3 | 2<br>3<br>4 | 48 | 3.3 | 5.1 | 42.4<br>44.7<br>48.9 | 44.2<br>46.6<br>51.1 | 8.3<br>8.7   | 5.5<br>5.2<br>5.7 | 68.8<br>72.5<br>79.5 | 1.3<br>1.3<br>1.5 | 11.2<br>7.0<br>7.7 | 4.9<br>5.1<br>5.6  | 0.01<br>0.01<br>0.01 | 2.48<br>2.61<br>2.86 | 2.39<br>2.52<br>2.76 | 4.0 | 1970 | 2080 | 2130 | 12,640<br>13,320<br>14,590 | 84 |
|           | Lower Freeport (No. 6A)   | 1483            | 3 | 2<br>3<br>4 | 19 | 3.9 | 5.5 | 32.6<br>34.5<br>47.0 | 36.7<br>38.9<br>53.0 | 25.2<br>26.7 | 4.5<br>4.1<br>5.6 | 53.0<br>56.1<br>76.5 | 1.0<br>1.1<br>1.4 | 9.1<br>4.4<br>6.1  | 7.2<br>7.6<br>10.4 | 0.02<br>0.02<br>0.03 | 4.46<br>4.72<br>6.44 | 2.74<br>2.90<br>3.95 | 4.0 | 1970 | 2120 | 2160 | 9,790<br>10,360<br>14,130  | 84 |
| Cambridge | Not designated            | 1502            | 3 | 2<br>3<br>4 | 27 | 4.2 | 6.2 | 34.2<br>36.4<br>42.8 | 45.6<br>48.6<br>57.2 | 14.0<br>14.9 | 5.3<br>5.0<br>5.8 | 65.7<br>70.0<br>82.3 | 1.6<br>1.7<br>2.0 | 12.8<br>7.8<br>9.2 | 0.6<br>0.6<br>0.7  | 0.01<br>0.01<br>0.01 | 0.08<br>0.09<br>0.10 |                      |     |      |      |      |                            |    |



| Township                    | Seam                      | DGS file no. | Kind | Condition | Analyzed thick-ness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                 |              |      | Ultimate analysis (%) |        |          |        |              | Forms of sulfur (%) |         |         | Free-swelling index | Fusibility of ash (°F)          |                       |                   |        | Heating value (Btu/lb) | Year |
|-----------------------------|---------------------------|--------------|------|-----------|----------------------------------|--------------------|------------------------|-----------------|--------------|------|-----------------------|--------|----------|--------|--------------|---------------------|---------|---------|---------------------|---------------------------------|-----------------------|-------------------|--------|------------------------|------|
|                             |                           |              |      |           |                                  |                    | Moisture               | Volatile matter | Fixed carbon | Ash  | Hydrogen              | Carbon | Nitrogen | Oxygen | Total sulfur | Sulfate             | Pyritic | Organic |                     | Initial deformation temperature | Softening temperature | Fluid temperature |        |                        |      |
|                             |                           |              |      |           |                                  |                    |                        |                 |              |      |                       |        |          |        |              |                     |         |         |                     |                                 |                       |                   |        |                        |      |
| GUERNSEY COUNTY (continued) |                           |              |      |           |                                  |                    |                        |                 |              |      |                       |        |          |        |              |                     |         |         |                     |                                 |                       |                   |        |                        |      |
| Monroe                      | Middle Kittanning (No. 6) | 1480         | 3    | 2         | 33                               | 4.5                | 6.6                    | 41.1            | 46.2         | 6.1  | 5.7                   | 71.0   | 1.2      | 12.4   | 3.5          | 0.01                | 1.85    | 1.68    | 3.0                 | 1870                            | 2040                  | 2100              | 12,840 | 84                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 44.0            | 49.5         | 6.6  | 5.3                   | 76.0   | 1.3      | 7.0    | 3.8          | 0.01                | 1.98    | 1.80    |                     |                                 |                       |                   | 13,740 |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 47.1            | 52.9         |      | 5.7                   | 81.4   | 1.4      | 7.5    | 4.1          | 0.01                | 2.12    | 1.92    |                     |                                 |                       |                   | 14,710 |                        |      |
|                             | Not designated            | 1481         | 3    | 2         | 17                               | 2.1                | 3.9                    | 36.6            | 37.3         | 22.1 | 4.8                   | 58.8   | 1.2      | 10.3   | 2.8          | 0.01                | 1.77    | 1.00    | 4.0                 | 2750                            | 2800                  | 2800              | 10,720 | 84                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 38.1            | 38.9         | 23.0 | 4.5                   | 61.2   | 1.3      | 7.1    | 2.9          | 0.01                | 1.84    | 1.04    |                     |                                 |                       |                   | 11,160 |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 49.5            | 50.5         |      | 5.9                   | 79.5   | 1.7      | 9.2    | 3.8          | 0.01                | 2.39    | 1.35    |                     |                                 |                       |                   | 14,490 |                        |      |
| Oxford                      | Bedford                   | 1454         | 3    | 2         | 17                               | 0.5                | 2.3                    | 24.6            | 30.2         | 42.8 | 3.4                   | 43.3   | 0.7      | 7.9    | 1.8          | 0.00                | 1.04    | 0.80    | 1.0                 | 2650                            | 2800                  | 2800              | 7,720  | 83                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 25.2            | 30.9         | 43.9 | 3.2                   | 44.3   | 0.8      | 6.0    | 1.9          | 0.00                | 1.07    | 0.82    |                     |                                 |                       |                   | 7,900  |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 44.9            | 55.1         |      | 5.7                   | 79.0   | 1.3      | 10.6   | 3.4          | 0.00                | 1.90    | 1.46    |                     |                                 |                       |                   | 14,080 |                        |      |
|                             | Brookville (No. 4)        | 1461         | 3    | 2         | 17                               | 0.6                | 2.3                    | 38.6            | 42.1         | 17.0 | 5.1                   | 65.9   | 1.2      | 8.3    | 2.5          | 0.02                | 1.07    | 1.43    | 4.0                 | 2280                            | 2510                  | 2560              | 11,910 | 83                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 39.6            | 43.1         | 17.4 | 4.9                   | 67.5   | 1.2      | 6.4    | 2.6          | 0.02                | 1.10    | 1.46    |                     |                                 |                       |                   | 12,190 |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 47.9            | 52.1         |      | 6.0                   | 81.7   | 1.5      | 7.7    | 3.1          | 0.02                | 1.33    | 1.77    |                     |                                 |                       |                   | 14,750 |                        |      |
|                             | Middle Kittanning (No. 6) | 1453         | 3    | 2         | 39                               | 0.4                | 2.1                    | 38.6            | 41.5         | 17.8 | 4.9                   | 63.5   | 1.2      | 8.3    | 4.3          | 0.11                | 2.09    | 2.07    | 5.5                 | 2200                            | 2400                  | 2520              | 11,760 | 83                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 39.4            | 42.4         | 18.2 | 4.8                   | 64.9   | 1.2      | 6.5    | 4.4          | 0.11                | 2.14    | 2.12    |                     |                                 |                       |                   | 12,020 |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 48.2            | 51.8         |      | 5.8                   | 79.4   | 1.4      | 8.0    | 5.3          | 0.14                | 2.61    | 2.59    |                     |                                 |                       |                   | 14,690 |                        |      |
|                             | Lower Freeport (No. 6A)   | 1452         | 3    | 2         | 54                               | 0.4                | 2.4                    | 41.3            | 48.2         | 8.1  | 5.4                   | 73.3   | 1.4      | 9.2    | 2.7          | 0.02                | 1.45    | 1.20    | 5.5                 | 2030                            | 2100                  | 2360              | 13,310 | 83                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 42.4            | 49.3         | 8.3  | 5.3                   | 75.0   | 1.4      | 7.2    | 2.7          | 0.02                | 1.49    | 1.23    |                     |                                 |                       |                   | 13,640 |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 46.2            | 53.8         |      | 5.8                   | 81.8   | 1.5      | 7.9    | 3.0          | 0.02                | 1.62    | 1.34    |                     |                                 |                       |                   | 14,870 |                        |      |
|                             | Wilgus                    | 1460         | 3    | 2         | 15                               | 0.5                | 2.2                    | 38.1            | 43.0         | 16.8 | 4.9                   | 63.7   | 1.2      | 7.9    | 5.6          | 0.08                | 2.79    | 2.74    | 6.5                 | 2030                            | 2110                  | 2140              | 11,690 | 83                     |      |
|                             |                           |              |      | 3         |                                  |                    |                        | 38.9            | 43.9         | 17.2 | 4.7                   | 65.1   | 1.2      | 6.1    | 5.7          | 0.08                | 2.85    | 2.80    |                     |                                 |                       |                   | 11,950 |                        |      |
|                             |                           |              |      | 4         |                                  |                    |                        | 47.0            | 53.0         |      | 5.7                   | 78.6   | 1.4      | 7.4    | 6.9          | 0                   |         |         |                     |                                 |                       |                   |        |                        |      |

|          |                           |                    |      |             |             |     |     |                      |                      |                      |                   |                      |                      |                    |                   |                      |                      |                      |                      |      |      |      |                            |                            |    |
|----------|---------------------------|--------------------|------|-------------|-------------|-----|-----|----------------------|----------------------|----------------------|-------------------|----------------------|----------------------|--------------------|-------------------|----------------------|----------------------|----------------------|----------------------|------|------|------|----------------------------|----------------------------|----|
| Valley   | Anderson                  | 1489               | 3    | 2<br>3<br>4 | 26          | 3.9 | 6.0 | 37.9<br>40.4<br>46.3 | 44.1<br>46.9<br>53.7 | 11.9<br>12.7         | 5.2<br>4.9<br>5.6 | 65.9<br>70.1<br>80.3 | 1.3<br>1.4<br>1.6    | 13.1<br>8.3<br>9.5 | 2.5<br>2.7<br>3.0 | 0.01<br>0.01<br>0.01 | 1.14<br>1.21<br>1.39 | 1.35<br>1.44<br>1.65 | 4.0                  | 2090 | 2260 | 2300 | 11,780<br>12,530<br>14,350 | 84                         |    |
|          |                           | 1496               | 3    | 2<br>3<br>4 | 33          | 4.5 | 5.7 | 39.1<br>41.5<br>47.5 | 43.3<br>46.0<br>52.5 | 11.8<br>12.5         | 5.3<br>5.0<br>5.7 | 65.0<br>68.9<br>78.8 | 1.2<br>1.2<br>1.4    | 12.2<br>7.6<br>8.7 | 4.4<br>4.7<br>5.3 | 0.01<br>0.01<br>0.01 | 2.73<br>2.89<br>3.31 | 1.65<br>1.75<br>2.00 | 5.0                  | 1990 | 2130 | 2280 | 11,770<br>12,480<br>14,270 | 84                         |    |
|          | Lower Freeport (No. 6A)   | 1482               | 3    | 2<br>3<br>4 | 33          | 3.7 | 5.6 | 40.0<br>42.3<br>46.5 | 46.0<br>48.7<br>53.5 | 8.5<br>9.0           | 5.4<br>5.1<br>5.6 | 69.1<br>73.2<br>80.4 | 1.2<br>1.3<br>1.4    | 11.8<br>7.2<br>7.9 | 4.0<br>4.3<br>4.7 | 0.02<br>0.02<br>0.02 | 2.22<br>2.35<br>2.58 | 1.78<br>1.88<br>2.07 | 2.5                  | 1970 | 2100 | 2150 | 12,590<br>13,330<br>14,640 | 84                         |    |
|          | Washington                | Brookville (No. 4) | 1473 | 3           | 2<br>3<br>4 | 15  | 0.5 | 2.2                  | 40.0<br>40.9<br>49.3 | 41.1<br>42.0<br>50.7 | 16.7<br>17.1      | 5.1<br>5.0<br>6.0    | 65.2<br>66.6<br>80.4 | 1.6<br>1.6<br>1.9  | 9.7<br>7.9<br>9.5 | 1.8<br>1.8<br>2.2    | 0.03<br>0.03<br>0.04 | 0.47<br>0.48<br>0.58 | 1.26<br>1.29<br>1.55 | 4.5  | 2760 | 2800 | 2800                       | 11,960<br>12,230<br>14,750 | 83 |
|          | Middle Kittanning (No. 6) | 1472               | 3    | 2<br>3<br>4 | 42          | 1.1 | 3.2 | 39.0<br>40.2<br>46.2 | 45.3<br>46.8<br>53.8 | 12.6<br>13.0         | 5.1<br>5.0<br>5.7 | 67.1<br>69.4<br>79.7 | 1.2<br>1.2<br>1.4    | 10.2<br>7.6<br>8.7 | 3.8<br>3.9<br>4.5 | 0.09<br>0.09<br>0.11 | 2.01<br>2.08<br>2.39 | 1.66<br>1.71<br>1.97 | 3.5                  | 1970 | 2070 | 2110 | 12,160<br>12,560<br>14,430 | 83                         |    |
|          | Lower Freeport (No. 6A)   | 1471               | 3    | 2<br>3<br>4 | 15          | 0.5 | 2.3 | 38.0<br>38.9<br>48.0 | 41.2<br>42.2<br>52.0 | 18.5<br>18.9         | 4.8<br>4.7<br>5.8 | 61.7<br>63.1<br>77.9 | 1.1<br>1.1<br>1.3    | 7.8<br>5.9<br>7.3  | 6.1<br>6.3<br>7.7 | 0.11<br>0.11<br>0.14 | 3.49<br>3.57<br>4.41 | 2.53<br>2.59<br>3.19 | 3.5                  | 1970 | 2100 | 2140 | 11,410<br>11,680<br>14,400 | 83                         |    |
| Westland | Lower Kittanning (No. 5)  | 1488               | 3    | 2<br>3<br>4 | 15          | 2.5 | 4.3 | 40.8<br>42.7<br>49.1 | 42.4<br>44.3<br>50.9 | 12.5<br>13.0         | 5.0<br>4.8<br>5.5 | 63.1<br>66.0<br>75.9 | 1.1<br>1.2<br>1.4    | 10.3<br>6.7<br>7.7 | 7.9<br>8.3<br>9.5 | 0.00<br>0.00<br>0.00 | 5.05<br>5.28<br>6.07 | 2.88<br>3.01<br>3.46 | 3.5                  | 2150 | 2300 | 2340 | 11,890<br>12,430<br>14,290 | 84                         |    |
|          | Middle Kittanning (No. 6) | 1487               | 3    | 2<br>3<br>4 | 26          | 3.2 | 5.3 | 39.2<br>41.4<br>47.1 | 44.1<br>46.6<br>52.9 | 11.3<br>12.0         | 5.3<br>5.0<br>5.7 | 65.8<br>69.5<br>78.9 | 1.3<br>1.4<br>1.6    | 11.7<br>7.4<br>8.4 | 4.5<br>4.8<br>5.4 | 0.01<br>0.01<br>0.01 | 2.52<br>2.66<br>3.02 | 2.01<br>2.12<br>2.41 | 2.0                  | 2000 | 2150 | 2220 | 12,070<br>12,740<br>14,470 | 84                         |    |
| Wills    | Brookville (No. 4)        | 1479               | 3    | 2<br>3<br>4 | 20          | 0.6 | 2.3 | 37.6<br>38.5<br>47.0 | 42.3<br>43.4<br>53.0 | 17.7<br>18.2         | 4.9<br>4.8<br>5.8 | 64.2<br>65.8<br>80.3 | 1.3<br>1.3<br>1.6    | 9.6<br>7.7<br>9.4  | 2.3<br>2.3<br>2.8 | 0.01<br>0.01<br>0.01 | 1.05<br>1.08<br>1.31 | 1.20<br>1.23<br>1.50 | 4.5                  | 2520 | 2630 | 2660 | 11,710<br>11,980<br>14,640 | 84                         |    |
|          | Lower Kittanning (No. 5)  | 1478               | 3    | 2<br>3<br>4 | 35          | 0.8 | 2.6 | 40.9<br>42.0<br>46.7 | 46.7<br>47.9<br>53.3 | 9.8<br>10.1          | 5.8<br>5.7<br>6.3 | 68.5<br>70.3<br>78.2 | 1.4<br>1.4<br>1.6    | 9.4<br>7.3<br>8.1  | 5.1<br>5.3<br>5.8 | 0.05<br>0.05<br>0.06 | 2.96<br>3.04<br>3.38 | 2.11<br>2.17<br>2.41 | 4.0                  | 1940 | 1980 | 2000 | 12,850<br>13,190<br>14,670 | 84                         |    |
|          | Middle Kittanning (No. 6) | 1477               | 3    | 2<br>3<br>4 | 40          | 0.7 | 2.7 | 40.9<br>42           |                      |                      |                   |                      |                      |                    |                   |                      |                      |                      |                      |      |      |      |                            |                            |    |



| Township                 | Seam                      | DGS file no. | Kind | Condition   | Analyzed thick-ness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                      |                      |                     | Ultimate analysis (%) |                      |                   |                      |                      | Forms of sulfur (%)  |                      |                      | Free-swelling index  | Fusibility of ash (°F)          |                       |                   | Year                       |                        |
|--------------------------|---------------------------|--------------|------|-------------|----------------------------------|--------------------|------------------------|----------------------|----------------------|---------------------|-----------------------|----------------------|-------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------------------|-----------------------|-------------------|----------------------------|------------------------|
|                          |                           |              |      |             |                                  |                    | Moisture               | Volatile matter      | Fixed carbon         | Ash                 | Hydrogen              | Carbon               | Nitrogen          | Oxygen               | Total sulfur         | Sulfate              | Pyritic              | Organic              |                      | Initial deformation temperature | Softening temperature | Fluid temperature |                            | Heating value (Btu/lb) |
| STARK COUNTY (continued) |                           |              |      |             |                                  |                    |                        |                      |                      |                     |                       |                      |                   |                      |                      |                      |                      |                      |                      |                                 |                       |                   |                            |                        |
| Bethlehem (continued)    | Middle Kittanning (No. 6) | 1416         | 2    | 2<br>3<br>4 | 49                               | 5.2                | 9.8                    | 35.5<br>39.3<br>43.5 | 46.1<br>51.1<br>56.5 | 8.6<br>9.6<br>5.2   | 5.3<br>4.7<br>5.2     | 62.7<br>69.5<br>76.9 | 1.2<br>1.3<br>1.5 | 20.2<br>12.8<br>14.1 | 1.9<br>2.1<br>2.3    | 0.20<br>0.22<br>0.25 | 0.27<br>0.30<br>0.33 | 1.44<br>1.60<br>1.76 | 0.5                  | 2090                            | 2170                  | 2230              | 11,090<br>12,290<br>13,590 | 83                     |
| Osnaburg                 | Lower Freeport (No. 6A)   | 1421         | 2    | 2<br>3<br>4 | 23                               | 2.2                | 5.2                    | 33.4<br>35.3<br>43.5 | 43.5<br>45.9<br>56.5 | 17.8<br>18.8<br>5.8 | 5.1<br>4.7<br>5.8     | 60.7<br>64.1<br>79.0 | 1.1<br>1.2<br>1.5 | 12.8<br>8.6<br>10.6  | 2.4<br>2.5<br>3.1    | 0.18<br>0.19<br>0.23 | 1.14<br>1.20<br>1.48 | 1.09<br>1.15<br>1.42 | 1.0                  | 2330                            | 2450                  | 2500              | 10,850<br>11,450<br>14,110 | 83                     |
| Paris                    | Upper Freeport (No. 7)    | 1432         | 2    | 2<br>3<br>4 | 28                               | 2.5                | 6.6                    | 32.5<br>34.8<br>39.7 | 49.3<br>52.8<br>60.3 | 11.6<br>12.4<br>5.5 | 5.2<br>4.8<br>5.5     | 65.8<br>70.4<br>80.5 | 1.4<br>1.5<br>1.7 | 14.3<br>9.0<br>10.3  | 1.7<br>1.8<br>2.1    | 0.11<br>0.12<br>0.13 | 1.05<br>1.12<br>1.28 | 0.54<br>0.58<br>0.66 | 2.5                  | 2010                            | 2080                  | 2130              | 11,650<br>12,470<br>14,240 | 83                     |
| Pike                     | Brookville (No. 4)        | 1418         | 2    | 2<br>3<br>4 | 20                               | 1.0                | 3.4                    | 40.5<br>41.9<br>46.5 | 46.6<br>48.2<br>53.5 | 9.5<br>9.8<br>5.9   | 5.5<br>5.3<br>5.9     | 69.8<br>72.2<br>80.1 | 1.4<br>1.4<br>1.6 | 11.8<br>9.0<br>10.0  | 2.1<br>2.2<br>2.4    | 0.04<br>0.04<br>0.05 | 0.43<br>0.45<br>0.49 | 1.61<br>1.67<br>1.85 | 2.5                  | 2580                            | 2660                  | 2720              | 12,640<br>13,090<br>14,520 | 83                     |
|                          |                           |              |      | 2<br>3<br>4 |                                  |                    |                        | 17                   | 1.7                  | 5.5                 | 39.7<br>42.0<br>44.7  | 49.2<br>52.0<br>55.3 | 5.6<br>6.0<br>5.5 | 5.5<br>5.2<br>5.5    | 70.0<br>74.1<br>78.8 | 1.4<br>1.5<br>1.6    | 14.6<br>10.3<br>11.0 | 2.8<br>3.0<br>3.2    | 0.30<br>0.32<br>0.34 | 0.82<br>0.87<br>0.92            | 1.72<br>1.82<br>1.93  | 0.5               | 2070                       | 2150                   |
|                          | Lower Kittanning (No. 5)  | 1386         | 2    | 2<br>3<br>4 | 36 <sup>3</sup>                  | 1.4                | 4.4                    | 40.6<br>42.5<br>46.6 | 46.6<br>48.7<br>53.4 | 8.4<br>8.7<br>5.5   | 5.3<br>5.0<br>5.5     | 67.7<br>70.8<br>77.6 | 1.3<br>1.4<br>1.5 | 13.6<br>10.2<br>11.1 | 3.8<br>3.9<br>4.3    | 0.24<br>0.25<br>0.28 | 1.42<br>1.49<br>1.63 | 2.11<br>2.21<br>2.42 | 2.5                  | 2060                            | 2150                  | 2400              | 12,430<br>13,000<br>14,240 | 83                     |
|                          |                           |              |      |             |                                  |                    |                        |                      |                      |                     |                       |                      |                   |                      |                      |                      |                      |                      |                      |                                 |                       |                   |                            |                        |
| TUSCARAWAS COUNTY        |                           |              |      |             |                                  |                    |                        |                      |                      |                     |                       |                      |                   |                      |                      |                      |                      |                      |                      |                                 |                       |                   |                            |                        |
| Sandy                    | Middle Kittanning (No. 6) | 1448         | 2    | 2<br>3<br>4 | 36                               | 1.9                | 4.6                    | 41.3<br>43.3<br>47.9 | 45.0<br>47.2<br>52.1 | 9.0<br>9.5<br>5.7   | 5.4<br>5.1<br>5.7     | 68.1<br>71.4<br>78.9 | 1.2<br>1.3<br>1.4 | 11.3<br>7.5<br>8.3   | 4.9<br>5.2<br>5.7    | 0.34<br>0.36<br>0.39 | 2.42<br>2.54<br>2.80 | 2.18<br>2.29<br>2.52 | 3.0                  | 1880                            | 1990                  | 2030              | 12,440<br>13,040<br>14,400 | 83                     |
| VINTON COUNTY            |                           |              |      |             |                                  |                    |                        |                      |                      |                     |                       |                      |                   |                      |                      |                      |                      |                      |                      |                                 |                       |                   |                            |                        |
| Knox                     | Brookville (No. 4)        | 1002         | 3    | 2<br>3<br>4 | 34                               | 5.0                | 7.4                    | 33.2<br>35.9<br>42.4 | 45.1<br>48.7<br>57.6 | 14.3<br>15.5<br>5.2 | 4.9<br>4.4<br>5.2     | 63.1<br>68.2<br>80.7 | 1.3<br>1.4<br>1.7 | 14.3<br>8.3<br>9.9   | 2.0<br>2.1<br>2.5    | 0.06<br>0.06<br>0.08 | 1.32<br>1.43<br>1.69 | 0.60<br>0.65<br>0.77 | 1.0                  | 2580                            | 2760                  | 2790              | 11,110<br>11,990<br>14,190 | 82                     |
|                          | Clarion (No. 4A)          | 1001         | 3    | 2<br>3<br>4 | 26                               | 2.8                | 5.0                    | 42.2<br>44.4<br>48.9 | 44.1<br>46.4<br>51.1 | 8.7<br>9.2<br>6.1   | 5.8<br>5.5<br>6.1     | 66.7<br>70.2<br>77.3 | 1.4<br>1.4<br>1.6 | 14.1<br>10.2<br>11.3 | 3.3<br>3.4<br>3.8    | 0.03<br>0.03<br>0.03 | 1.26<br>1.33<br>1.46 | 1.97<br>2.07<br>2.28 | 3.0                  | 2400                            | 2550                  | 2580              | 12,360<br>13,010<br>14,320 | 82                     |



TABLE 4.—Proximate-ultimate coal analyses by bed

Key to symbols by column:

DGS file no.:

4-digit number - production bench or whole-bed channel or core sample; taken in conformity with Holmes, 1911; Fieldner and Selvig, 1938

-1, -2 - samples taken in benches or from roof or floor coal

Kind:

2 - channel (strip mine)

3 - core

Condition:

2 - as received

3 - moisture-free

4 - moisture- and ash-free

Analyzed thickness:

1 - upper bench

2 - middle bench

3 - sample from pyrite study, crushed to minus  $\frac{3}{8}$ " at DGS before shipment for analysis

Tentative bed designation denoted by ?

| County                   | Township    | DGS file no. | Kind | Condition   | Analyzed thick-ness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                      |                      |              | Ultimate analysis (%) |                      |                   |                     |                   | Forms of sulfur (%)  |                      |                      | Free-swelling index | Fusibility of ash (°F)          |                       |                   | Heating value (Btu/lb)     | Year |  |
|--------------------------|-------------|--------------|------|-------------|----------------------------------|--------------------|------------------------|----------------------|----------------------|--------------|-----------------------|----------------------|-------------------|---------------------|-------------------|----------------------|----------------------|----------------------|---------------------|---------------------------------|-----------------------|-------------------|----------------------------|------|--|
|                          |             |              |      |             |                                  |                    | Moisture               | Volatile matter      | Fixed carbon         | Ash          | Hydrogen              | Carbon               | Nitrogen          | Oxygen              | Total sulfur      | Sulfate              | Pyritic              | Organic              |                     | Initial deformation temperature | Softening temperature | Fluid temperature |                            |      |  |
| SHARON (NO. 1) COAL      |             |              |      |             |                                  |                    |                        |                      |                      |              |                       |                      |                   |                     |                   |                      |                      |                      |                     |                                 |                       |                   |                            |      |  |
| Jackson                  | Bloomfield  | 1005         | 3    | 2<br>3<br>4 | 36                               | 5.8                | 8.6                    | 35.6<br>39.0<br>45.1 | 43.4<br>47.5<br>54.9 | 12.4<br>13.5 | 5.6<br>5.1<br>5.8     | 63.0<br>69.0<br>79.8 | 1.2<br>1.3<br>1.5 | 16.5<br>9.6<br>11.1 | 1.4<br>1.5<br>1.7 | 0.05<br>0.05<br>0.06 | 1.00<br>1.09<br>1.27 | 0.31<br>0.34<br>0.39 | 1.0                 | 2660                            | 2720                  | 2740              | 11,290<br>12,360<br>14,300 | 82   |  |
| QUAKERTOWN (NO. 2)? COAL |             |              |      |             |                                  |                    |                        |                      |                      |              |                       |                      |                   |                     |                   |                      |                      |                      |                     |                                 |                       |                   |                            |      |  |
| Belmont                  | Kirkwood    | 1409         | 3    | 2<br>3<br>4 | 21                               | 1.4                | 2.5                    | 35.5<br>36.4<br>42.6 | 47.8<br>49.0<br>57.4 | 14.3<br>14.6 | 5.1<br>5.0<br>5.8     | 68.2<br>70.0<br>82.0 | 1.2<br>1.2<br>1.4 | 9.3<br>7.3<br>8.6   | 1.9<br>1.9<br>2.2 | 0.03<br>0.03<br>0.04 | 1.18<br>1.21<br>1.42 | 0.65<br>0.67<br>0.78 | 4.5                 | 2560                            | 2670                  | 2730              | 12,310<br>12,620<br>14,790 | 83   |  |
|                          |             | 1431         | 3    | 2<br>3<br>4 | 23                               | 0.3                | 1.6                    | 38.3<br>39.0<br>43.0 | 50.7<br>51.6<br>57.0 | 9.3<br>9.4   | 5.3<br>5.2<br>5.7     | 73.4<br>74.7<br>82.4 | 1.2<br>1.3<br>1.4 | 8.4<br>7.0<br>7.8   | 2.4<br>2.4<br>2.7 | 0.02<br>0.02<br>0.02 | 1.52<br>1.55<br>1.71 | 0.86<br>0.87<br>0.97 | 4.5                 | 2130                            | 2380                  | 2420              | 13,190<br>13,410<br>14,810 | 83   |  |
| Guernsey                 | Londonderry | 1470         | 3    | 2<br>3<br>4 | 19                               | 0.6                | 2.5                    | 35.3<br>36.2<br>41.7 | 49.4<br>50.7<br>58.3 | 12.8<br>13.1 | 5.0<br>4.8<br>5.5     | 69.7<br>71.5<br>82.3 | 1.1<br>1.1<br>1.3 | 9.7<br>7.8<br>8.9   | 1.7<br>1.8<br>2.0 | 0.02<br>0.02<br>0.02 | 1.19<br>1.22<br>1.40 | 0.50<br>0.51<br>0.59 | 3.5                 | 2430                            | 2530                  | 2580              | 12,560<br>12,870<br>14,820 | 83   |  |
|                          | Spencer     | 1500         | 3    | 2<br>3<br>4 | 29                               | 3.8                | 5.5                    | 35.4<br>37.5<br>42.1 | 48.8<br>51.6<br>57.9 | 10.3<br>10.9 | 5.5<br>5.2<br>5.8     | 68.8<br>72.8<br>81.7 | 1.4<br>1.5<br>1.6 | 12.2<br>7.8<br>8.7  | 1.7<br>1.8<br>2.0 | 0.00<br>0.00<br>0.00 | 1.11<br>1.17<br>1.32 | 0.61<br>0.65<br>0.72 | 4.5                 | 2540                            | 2690                  | 2760              | 12,360<br>13,070<br>14,680 | 84   |  |
| BEDFORD COAL             |             |              |      |             |                                  |                    |                        |                      |                      |              |                       |                      |                   |                     |                   |                      |                      |                      |                     |                                 |                       |                   |                            |      |  |
| Guernsey                 | Oxford      | 1454         | 3    | 2<br>3<br>4 | 17                               | 0.5                | 2.3                    | 24.6<br>25.2<br>44.9 | 30.2<br>30.9<br>55.1 | 42.8<br>43.9 | 3.4<br>3.2<br>5.7     | 43.3<br>44.3<br>79.0 | 0.7<br>0.8<br>1.3 | 7.9<br>6.0<br>10.6  | 1.8<br>1.9<br>3.4 | 0.00<br>0.00<br>0.00 | 1.04<br>1.07<br>1.90 | 0.80<br>0.82<br>1.46 | 1.0                 | 2650                            | 2800                  | 2800              | 7,720<br>7,900<br>14,080   | 83   |  |
| BROOKVILLE (NO. 4) COAL  |             |              |      |             |                                  |                    |                        |                      |                      |              |                       |                      |                   |                     |                   |                      |                      |                      |                     |                                 |                       |                   |                            |      |  |
| Belmont                  | York        | 1414         | 3    | 2<br>3<br>4 | 46                               | 0.2                | 1.4                    | 31.7<br>32.1<br>42.3 | 43.2<br>43.9<br>57.7 | 23.7<br>24.0 | 4.4<br>4.3<br>5.6     | 60.9<br>61.7<br>81.2 | 1.2<br>1.2<br>1.6 | 8.0<br>6.8<br>9.0   | 2.0<br>2.0<br>2.6 | 0.02<br>0.02<br>0.03 | 1.04<br>1.05<br>1.39 | 0.90<br>0.91<br>1.20 | 4.0                 | 2790                            | 2800                  | 2800              | 10,940<br>11,100<br>14,610 | 83   |  |
| Guernsey                 | Jefferson   | 1476         | 3    | 2<br>3<br>4 | 19                               | 0.7                | 2.7                    | 38.3<br>39.4<br>46.7 | 43.7<br>45.0<br>53.3 | 15.2<br>15.7 | 4.8<br>4.7<br>5.5     | 66.1<br>67.9<br>80.5 | 1.3<br>1.3<br>1.6 | 10.3<br>8.1<br>9.6  | 2.3<br>2.3<br>2.8 | 0.03<br>0.03<br>0.04 | 0.96<br>0.99<br>1.17 | 1.28<br>1.32<br>1.56 | 4.5                 | 2290                            | 2370                  | 2390              | 12,080<br>12,420<br>14,730 | 84   |  |
|                          | Oxford      | 1461         | 3    | 2<br>3<br>4 | 17                               | 0.6                | 2.3                    | 38.6<br>39.6<br>47.9 | 42.1<br>43.1<br>52.1 | 17.0<br>17.4 | 5.1<br>4.9<br>6.0     | 65.9<br>67.5<br>81.7 | 1.2<br>1.2<br>1.5 | 8.3<br>6.4<br>7.7   | 2.5<br>2.6<br>3.1 | 0.02<br>0.02<br>0.02 | 1.07<br>1.10<br>1.33 | 1.43<br>1.46<br>1.77 | 4.0                 | 2280                            | 2510                  | 2560              | 11,910<br>12,190<br>14,750 | 83   |  |
|                          | Washington  | 1473         | 3    | 2<br>3<br>4 | 15                               | 0.5                | 2.2                    | 40.0<br>40.9<br>49.3 | 41.1<br>42.0<br>50.7 | 16.7<br>17.1 | 5.1<br>5.0<br>6.0     | 65.2<br>66.6<br>80.4 | 1.6<br>1.6<br>1.9 | 9.7<br>7.9<br>9.5   | 1.8<br>1.8<br>2.2 | 0.03<br>0.03<br>0.04 | 0.47<br>0.48<br>0.58 | 1.26<br>1.29<br>1.55 | 4.5                 | 2760                            | 2800                  | 2800              | 11,960<br>12,230<br>14,750 | 83   |  |

| County                              | Township | DGS file no. | Kind | Condition   | Analyzed thickness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                      |                      | Ultimate analysis (%) |                   |                      |                   |                      | Forms of sulfur (%) |                      |                      | Free-swelling index  | Fusibility of ash (°F) |                                 |                       | Heating value (Btu/lb) | Year                       |                   |  |
|-------------------------------------|----------|--------------|------|-------------|---------------------------------|--------------------|------------------------|----------------------|----------------------|-----------------------|-------------------|----------------------|-------------------|----------------------|---------------------|----------------------|----------------------|----------------------|------------------------|---------------------------------|-----------------------|------------------------|----------------------------|-------------------|--|
|                                     |          |              |      |             |                                 |                    | Moisture               | Volatile matter      | Fixed carbon         | Ash                   | Hydrogen          | Carbon               | Nitrogen          | Oxygen               | Total sulfur        | Sulfate              | Pyritic              |                      | Organic                | Initial deformation temperature | Softening temperature |                        |                            | Fluid temperature |  |
| BROOKVILLE (NO. 4) COAL (continued) |          |              |      |             |                                 |                    |                        |                      |                      |                       |                   |                      |                   |                      |                     |                      |                      |                      |                        |                                 |                       |                        |                            |                   |  |
| Guernsey (continued)                | Wills    | 1479         | 3    | 2<br>3<br>4 | 20 <sup>1</sup>                 | 0.6                | 2.3                    | 37.6<br>38.5<br>47.0 | 42.3<br>43.4<br>53.0 | 17.7<br>18.2<br>5.8   | 4.9<br>4.8<br>1.6 | 64.2<br>65.8<br>80.3 | 1.3<br>1.3<br>1.6 | 9.6<br>7.7<br>9.4    | 2.3<br>2.3<br>2.8   | 0.01<br>0.01<br>0.01 | 1.05<br>1.08<br>1.31 | 1.20<br>1.23<br>1.50 | 4.5                    | 2520                            | 2630                  | 2660                   | 11,710<br>11,980<br>14,640 | 84                |  |
| Stark                               | Pike     | 1418         | 2    | 2<br>3<br>4 | 20                              | 1.0                | 3.4                    | 40.5<br>41.9<br>46.5 | 46.6<br>48.2<br>53.5 | 9.5<br>9.8<br>5.9     | 5.5<br>5.3<br>5.5 | 69.8<br>72.2<br>80.1 | 1.4<br>1.4<br>1.6 | 11.8<br>9.0<br>10.0  | 2.1<br>2.2<br>2.4   | 0.04<br>0.04<br>0.05 | 0.43<br>0.45<br>0.49 | 1.61<br>1.67<br>1.85 | 2.5                    | 2580                            | 2660                  | 2720                   | 12,640<br>13,090<br>14,520 | 83                |  |
|                                     |          | 1434         | 2    | 2<br>3<br>4 | 17                              | 1.7                | 5.5                    | 39.7<br>42.0<br>44.7 | 49.2<br>52.0<br>55.3 | 5.6<br>6.0<br>5.5     | 5.5<br>5.2<br>5.5 | 70.0<br>74.1<br>78.8 | 1.4<br>1.5<br>1.6 | 14.6<br>10.3<br>11.0 | 2.8<br>3.0<br>3.2   | 0.30<br>0.32<br>0.34 | 0.82<br>0.87<br>0.92 | 1.72<br>1.82<br>1.93 | 0.5                    | 2070                            | 2150                  | 2200                   | 12,470<br>13,190<br>14,020 | 83                |  |
| Vinton                              | Knox     | 1002         | 3    | 2<br>3<br>4 | 34                              | 5.0                | 7.4                    | 33.2<br>35.9<br>42.4 | 45.1<br>48.7<br>57.6 | 14.3<br>15.5<br>5.2   | 4.9<br>4.4<br>5.2 | 63.1<br>68.2<br>80.7 | 1.3<br>1.4<br>1.7 | 14.3<br>8.3<br>9.9   | 2.0<br>2.1<br>2.5   | 0.06<br>0.06<br>0.08 | 1.32<br>1.43<br>1.69 | 0.60<br>0.65<br>0.77 | 1.0                    | 2580                            | 2760                  | 2790                   | 11,110<br>11,990<br>14,190 | 82                |  |
| CLARION (NO. 4A) COAL               |          |              |      |             |                                 |                    |                        |                      |                      |                       |                   |                      |                   |                      |                     |                      |                      |                      |                        |                                 |                       |                        |                            |                   |  |
| Belmont                             | Goshen   | 1405         | 3    | 2<br>3<br>4 | 26                              | 1.3                | 2.2                    | 40.7<br>41.7<br>46.8 | 46.3<br>47.4<br>53.2 | 10.7<br>10.9<br>5.9   | 5.4<br>5.3<br>5.9 | 71.7<br>73.3<br>82.4 | 1.4<br>1.4<br>1.6 | 7.9<br>6.1<br>6.9    | 2.9<br>2.9<br>3.3   | 0.02<br>0.02<br>0.02 | 1.72<br>1.76<br>1.97 | 1.13<br>1.16<br>1.30 | 4.5                    | 2080                            | 2190                  | 2380                   | 13,060<br>13,350<br>14,990 | 83                |  |
|                                     | Kirkwood | 1408         | 3    | 2<br>3<br>4 | 20                              | 1.1                | 2.2                    | 36.7<br>37.6<br>46.3 | 42.7<br>43.7<br>53.7 | 18.3<br>18.8<br>5.9   | 4.9<br>4.8<br>5.9 | 63.7<br>65.2<br>80.2 | 1.1<br>1.2<br>1.4 | 8.3<br>6.5<br>8.0    | 3.6<br>3.6<br>4.5   | 0.08<br>0.08<br>0.10 | 2.18<br>2.23<br>2.74 | 1.30<br>1.33<br>1.64 | 5.5                    | 2190                            | 2340                  | 2580                   | 11,650<br>11,910<br>14,660 | 83                |  |
|                                     |          | 1430         | 3    | 2<br>3<br>4 | 24 <sup>1</sup>                 | 0.4                | 2.0                    | 38.4<br>39.2<br>48.0 | 41.7<br>42.5<br>52.0 | 17.9<br>18.3<br>4.8   | 4.9<br>4.8<br>5.8 | 65.1<br>66.5<br>81.3 | 1.2<br>1.2<br>1.5 | 8.9<br>7.2<br>8.9    | 2.0<br>2.1<br>2.5   | 0.01<br>0.01<br>0.01 | 0.62<br>0.63<br>0.77 | 1.39<br>1.42<br>1.74 | 5.5                    | 2710                            | 2800                  | 2800                   | 11,820<br>12,060<br>14,760 | 83                |  |
|                                     |          | 1430-1       | 3    | 2<br>3<br>4 | 12 <sup>2</sup>                 | 0.2                | 1.3                    | 24.0<br>24.3<br>48.6 | 25.4<br>25.7<br>51.4 | 49.4<br>50.0<br>6.0   | 3.1<br>3.0<br>6.0 | 37.7<br>38.2<br>76.4 | 0.7<br>0.7<br>1.5 | 7.2<br>6.2<br>12.4   | 1.9<br>1.9<br>3.8   | 0.01<br>0.01<br>0.02 | 1.02<br>1.03<br>2.07 | 0.83<br>0.84<br>1.68 | 1.0                    | 2800                            | 2800                  | 2800                   | 6,950<br>7,040<br>14,090   | 83                |  |
| Gallia                              | Perry    | 1008         | 3    | 2<br>3<br>4 | 46                              | 3.1                | 5.3                    | 39.8<br>42.0<br>49.5 | 40.5<br>42.8<br>50.5 | 14.4<br>15.2<br>5.8   | 5.3<br>4.9<br>5.8 | 62.5<br>66.0<br>77.8 | 1.1<br>1.2<br>1.4 | 12.2<br>7.9<br>9.3   | 4.6<br>4.8<br>5.7   | 0.09<br>0.09<br>0.11 | 2.76<br>2.91<br>3.43 | 1.73<br>1.83<br>2.15 | 3.5                    | 1970                            | 2020                  | 2100                   | 11,460<br>12,090<br>14,260 | 82                |  |
|                                     | Raccoon  | 1003         | 3    | 2<br>3<br>4 | 31                              | 5.2                | 7.2                    | 38.1<br>41.1<br>48.4 | 40.6<br>43.8<br>51.6 | 14.0<br>15.1<br>5.3   | 5.0<br>4.5<br>5.3 | 61.7<br>66.5<br>78.3 | 1.2<br>1.3<br>1.5 | 13.3<br>7.4<br>8.7   | 4.8<br>5.2<br>6.1   | 0.16<br>0.17<br>0.20 | 3.36<br>3.62<br>4.27 | 1.31<br>1.41<br>1.66 | 3.0                    | 1950                            | 2060                  | 2110                   | 11,250<br>12,130<br>14,290 | 82                |  |
|                                     |          | 1004         | 3    | 2<br>3<br>4 | 29                              | 2.6                | 4.9                    | 35.7<br>37.6<br>49.5 | 36.4<br>38.3<br>50.5 | 22.9<br>24.1<br>5.7   | 4.7<br>4.3<br>5.7 | 53.5<br>56.3<br>74.2 | 1.0<br>1.1<br>1.4 | 11.3<br>7.3<br>9.6   | 6.6<br>6.9<br>9.1   | 0.23<br>0.24<br>0.32 | 4.92<br>5.18<br>6.82 | 1.43<br>1.50<br>1.98 | 2.5                    | 2100                            | 2260                  | 2320                   | 10,030<br>10,550<br>13,890 | 82                |  |
| Vinton                              | Knox     | 1001         | 3    | 2<br>3<br>4 | 26                              | 2.8                | 5.0                    | 42.2<br>44.4<br>48.9 | 44.1<br>46.4<br>51.1 | 8.7<br>9.2<br>6.1     | 5.8<br>5.5<br>6.1 | 66.7<br>70.2<br>77.3 | 1.4<br>1.4<br>1.6 | 14.1<br>10.2<br>11.3 | 3.3<br>3.4<br>3.8   | 0.03<br>0.03<br>0.03 | 1.26<br>1.33<br>1.46 | 1.97<br>2.07<br>2.28 | 3.0                    | 2400                            | 2550                  | 2580                   | 12,360<br>13,010<br>14,320 | 82                |  |
| LOWER KITTANNING (NO. 5) COAL       |          |              |      |             |                                 |                    |                        |                      |                      |                       |                   |                      |                   |                      |                     |                      |                      |                      |                        |                                 |                       |                        |                            |                   |  |
| Belmont                             | Goshen   | 1404         | 3    | 2<br>3<br>4 | 35                              | 1.4                | 2.3                    | 41.2<br>42.2<br>46.2 | 47.9<br>49.1<br>53.8 | 8.5<br>8.8<br>5.7     | 5.3<br>5.2<br>5.7 | 72.5<br>74.2<br>81.3 | 1.4<br>1.4<br>1.5 | 7.3<br>5.4<br>5.9    | 5.0<br>5.1<br>5.6   | 0.03<br>0.03<br>0.03 | 3.02<br>3.09<br>3.39 | 1.95<br>2.00<br>2.19 | 5.0                    | 1920                            | 2040                  | 2100                   | 13,330<br>13,650<br>14,950 | 83                |  |
|                                     | Kirkwood | 1397         | 3    | 2<br>3<br>4 | 31                              | 1.2                | 2.1                    | 40.6<br>41.4<br>47.3 | 45.2<br>46.2<br>52.7 | 12.1<br>12.4<br>5.7   | 5.1<br>5.0<br>5.7 | 68.8<br>70.3<br>80.2 | 1.3<br>1.4<br>1.6 | 7.4<br>5.7<br>6.5    | 5.1<br>5.3<br>6.0   | 0.12<br>0.12<br>0.14 | 3.19<br>3.26<br>3.72 | 1.84<br>1.88<br>2.14 | 4.5                    | 1900                            | 1990                  | 2100                   | 12,710<br>12,980<br>14,820 | 82                |  |
|                                     |          | 1407         | 3    | 2<br>3<br>4 | 38                              | 1.0                | 2.2                    | 40.1<br>41.0<br>47.1 | 45.1<br>46.1<br>52.9 | 12.6<br>12.9<br>5.7   | 5.1<br>5.0<br>5.7 | 68.9<br>70.5<br>80.9 | 1.2<br>1.3<br>1.5 | 7.3<br>5.5<br>6.3    | 4.8<br>4.9<br>5.6   | 0.16<br>0.16<br>0.19 | 2.97<br>3.04<br>3.49 | 1.64<br>1.68<br>1.92 | 3.5                    | 1920                            | 1960                  | 2140                   | 12,580<br>12,860<br>14,770 | 83                |  |
|                                     |          | 1429         | 3    | 2<br>3<br>4 | 39                              | 0.4                | 1.7                    | 33.2<br>33.8<br>47.1 | 37.4<br>38.0<br>52.9 | 27.7<br>28.1<br>5.7   | 4.2<br>4.1<br>5.7 | 57.6<br>58.6<br>81.5 | 1.1<br>1.1<br>1.6 | 6.2<br>4.7<br>6.6    | 3.3<br>3.4<br>4.7   | 0.09<br>0.09<br>0.13 | 1.68<br>1.71<br>2.38 | 1.53<br>1.56<br>2.17 | 4.5                    | 2800                            | 2800                  | 2800                   | 10,490<br>10,670<br>14,840 | 83                |  |



|                                       |             |      |   |             |                 |     |     |                      |                      |                     |                   |                      |                   |                      |                   |                      |                      |                      |     |      |      |      |                            |    |
|---------------------------------------|-------------|------|---|-------------|-----------------|-----|-----|----------------------|----------------------|---------------------|-------------------|----------------------|-------------------|----------------------|-------------------|----------------------|----------------------|----------------------|-----|------|------|------|----------------------------|----|
| Gallia                                | Richland    | 1447 | 3 | 2<br>3<br>4 | 50              | 0.3 | 1.8 | 39.2<br>39.9<br>43.3 | 51.2<br>52.1<br>56.7 | 7.8<br>8.0<br>5.9   | 5.5<br>5.4<br>5.9 | 75.2<br>76.6<br>83.2 | 1.5<br>1.5<br>1.6 | 8.2<br>6.7<br>7.3    | 1.8<br>1.8<br>2.0 | 0.01<br>0.01<br>0.01 | 1.06<br>1.08<br>1.17 | 0.71<br>0.72<br>0.79 | 5.0 | 2150 | 2440 | 2510 | 13,530<br>13,770<br>14,970 | 83 |
|                                       | Huntington  | 1009 | 3 | 2<br>3<br>4 | 46              | 3.3 | 5.3 | 37.6<br>39.7<br>47.6 | 41.3<br>43.6<br>52.4 | 15.8<br>16.7<br>5.7 | 5.0<br>4.7<br>5.7 | 61.1<br>64.5<br>77.4 | 1.1<br>1.1<br>1.4 | 11.5<br>7.2<br>8.6   | 5.5<br>5.8<br>7.0 | 0.10<br>0.11<br>0.13 | 3.57<br>3.77<br>4.52 | 1.87<br>1.97<br>2.37 | 1.5 | 1930 | 1990 | 2120 | 11,210<br>11,830<br>14,200 | 82 |
|                                       | Perry       | 1007 | 3 | 2<br>3<br>4 | 41              | 4.0 | 6.3 | 38.5<br>41.1<br>47.2 | 43.0<br>45.9<br>52.8 | 12.2<br>13.1<br>6.0 | 5.6<br>5.2<br>6.0 | 63.3<br>67.6<br>77.7 | 1.1<br>1.2<br>1.4 | 12.4<br>7.2<br>8.3   | 5.4<br>5.8<br>6.6 | 0.10<br>0.11<br>0.12 | 3.80<br>4.06<br>4.67 | 1.49<br>1.59<br>1.83 | 3.5 | 1930 | 1960 | 2020 | 11,660<br>12,450<br>14,320 | 82 |
| Guernsey                              | Adams       | 1486 | 3 | 2<br>3<br>4 | 45              | 2.3 | 4.0 | 41.0<br>42.7<br>52.0 | 37.8<br>39.4<br>48.0 | 17.3<br>18.0<br>4.8 | 5.0<br>4.8<br>5.9 | 60.6<br>63.1<br>77.0 | 1.0<br>1.1<br>1.3 | 8.6<br>5.3<br>6.5    | 7.4<br>7.7<br>9.4 | 0.02<br>0.02<br>0.03 | 4.44<br>4.62<br>5.64 | 2.92<br>3.04<br>3.71 | 2.5 | 2020 | 2150 | 2210 | 11,400<br>11,880<br>14,480 | 84 |
|                                       | Jackson     | 1495 | 3 | 2<br>3<br>4 | 26              | 4.4 | 6.0 | 40.5<br>43.0<br>46.8 | 46.0<br>49.0<br>53.2 | 7.5<br>8.0<br>5.8   | 5.6<br>5.3<br>5.8 | 70.6<br>75.0<br>81.6 | 1.3<br>1.4<br>1.5 | 12.0<br>7.1<br>7.7   | 3.0<br>3.2<br>3.4 | 0.01<br>0.01<br>0.01 | 1.65<br>1.75<br>1.91 | 1.32<br>1.40<br>1.53 | 5.5 | 2170 | 2250 | 2320 | 12,790<br>13,600<br>14,780 | 84 |
|                                       | Jefferson   | 1475 | 3 | 2<br>3<br>4 | 26              | 0.8 | 2.8 | 40.1<br>41.3<br>46.4 | 46.3<br>47.6<br>53.6 | 10.8<br>11.1<br>5.7 | 5.2<br>5.1<br>5.7 | 69.1<br>71.1<br>80.0 | 1.3<br>1.3<br>1.5 | 8.6<br>6.3<br>7.1    | 4.9<br>5.0<br>5.6 | 0.08<br>0.08<br>0.09 | 2.65<br>2.73<br>3.07 | 2.14<br>2.20<br>2.48 | 4.5 | 2010 | 2100 | 2240 | 12,560<br>12,930<br>14,550 | 84 |
|                                       | Londonderry | 1465 | 3 | 2<br>3<br>4 | 32              | 0.4 | 2.1 | 40.6<br>41.5<br>47.6 | 44.7<br>45.6<br>52.4 | 12.6<br>12.8<br>5.6 | 5.0<br>4.9<br>5.6 | 67.7<br>69.2<br>79.3 | 1.3<br>1.3<br>1.5 | 7.3<br>5.6<br>6.4    | 6.0<br>6.2<br>7.1 | 0.12<br>0.12<br>0.14 | 2.84<br>2.90<br>3.33 | 3.07<br>3.14<br>3.60 | 5.5 | 1960 | 2050 | 2100 | 12,480<br>12,740<br>14,620 | 83 |
|                                       | Richland    | 1505 | 3 | 2<br>3<br>4 | 31              | 2.1 | 3.6 | 37.9<br>39.3<br>46.8 | 43.1<br>44.7<br>53.2 | 15.4<br>16.0<br>5.8 | 5.1<br>4.9<br>5.8 | 65.7<br>68.2<br>81.1 | 1.4<br>1.5<br>1.7 | 9.3<br>6.3<br>7.5    | 3.0<br>3.2<br>3.8 | 0.01<br>0.01<br>0.01 | 1.54<br>1.60<br>1.90 | 1.50<br>1.56<br>1.85 | 3.5 | 2190 | 2450 | 2600 | 11,950<br>12,400<br>14,760 | 84 |
|                                       | Westland    | 1488 | 3 | 2<br>3<br>4 | 15              | 2.5 | 4.3 | 40.8<br>42.7<br>49.1 | 42.4<br>44.3<br>50.9 | 12.5<br>13.0<br>5.5 | 5.0<br>4.8<br>5.5 | 63.1<br>66.0<br>75.9 | 1.1<br>1.2<br>1.4 | 10.3<br>6.7<br>7.7   | 7.9<br>8.3<br>9.5 | 0.00<br>0.00<br>0.00 | 5.05<br>5.28<br>6.07 | 2.88<br>3.01<br>3.46 | 3.5 | 2150 | 2300 | 2340 | 11,890<br>12,430<br>14,290 | 84 |
| Stark                                 | Wills       | 1478 | 3 | 2<br>3<br>4 | 35              | 0.8 | 2.6 | 40.9<br>42.0<br>46.7 | 46.7<br>47.9<br>53.3 | 9.8<br>10.1<br>6.3  | 5.8<br>5.7<br>6.3 | 68.5<br>70.3<br>78.2 | 1.4<br>1.4<br>1.6 | 9.4<br>7.3<br>8.1    | 5.1<br>5.3<br>5.8 | 0.05<br>0.05<br>0.06 | 2.96<br>3.04<br>3.38 | 2.11<br>2.17<br>2.41 | 4.0 | 1940 | 1980 | 2000 | 12,850<br>13,190<br>14,670 | 84 |
|                                       | Pike        | 1386 | 2 | 2<br>3<br>4 | 36 <sup>3</sup> | 1.4 | 4.4 | 40.6<br>42.5<br>46.6 | 46.6<br>48.7<br>53.4 | 8.4<br>8.7<br>5.5   | 5.3<br>5.0<br>5.5 | 67.7<br>70.8<br>77.6 | 1.3<br>1.4<br>1.5 | 13.6<br>10.2<br>11.1 | 3.8<br>3.9<br>4.3 | 0.24<br>0.25<br>0.28 | 1.42<br>1.49<br>1.63 | 2.11<br>2.21<br>2.42 | 2.5 | 2060 | 2150 | 2400 | 12,430<br>13,000<br>14,240 | 83 |
| <b>STRASBURG (NO. 5A) COAL</b>        |             |      |   |             |                 |     |     |                      |                      |                     |                   |                      |                   |                      |                   |                      |                      |                      |     |      |      |      |                            |    |
| Carroll                               | Rose        | 1449 | 2 | 2<br>3<br>4 | 14              | 0.6 | 2.5 | 47.1<br>48.3<br>56.2 | 36.7<br>37.6<br>43.8 | 13.7<br>14.1<br>6.2 | 5.5<br>5.3<br>6.2 | 64.7<br>66.3<br>77.2 | 1.4<br>1.4<br>1.7 | 8.7<br>6.7<br>7.8    | 6.0<br>6.1<br>7.1 | 0.32<br>0.33<br>0.38 | 3.11<br>3.19<br>3.71 | 2.55<br>2.62<br>3.04 | 3.0 | 1970 | 2070 | 2110 | 12,140<br>12,450<br>14,490 | 83 |
| Guernsey                              | Adams       | 1485 | 3 | 2<br>3<br>4 | 33              | 2.3 | 3.9 | 44.4<br>46.2<br>52.3 | 40.4<br>42.1<br>47.7 | 11.3<br>11.7<br>5.8 | 5.4<br>5.1<br>5.8 | 66.4<br>69.1<br>78.3 | 1.1<br>1.2<br>1.4 | 10.2<br>7.0<br>7.9   | 5.6<br>5.8<br>6.6 | 0.02<br>0.02<br>0.02 | 3.03<br>3.15<br>3.57 | 2.54<br>2.64<br>3.00 | 3.5 | 1950 | 2110 | 2190 | 12,380<br>12,880<br>14,600 | 84 |
| Stark                                 | Bethlehem   | 1415 | 2 | 2<br>3<br>4 | 13              | 0.4 | 2.4 | 44.8<br>45.9<br>51.6 | 42.0<br>43.1<br>48.4 | 10.7<br>11.0<br>6.0 | 5.4<br>5.3<br>6.0 | 67.1<br>68.8<br>77.2 | 1.3<br>1.4<br>1.6 | 9.6<br>7.6<br>8.6    | 5.8<br>6.0<br>6.7 | 0.14<br>0.14<br>0.16 | 2.79<br>2.86<br>3.21 | 2.88<br>2.95<br>3.31 | 4.0 | 1980 | 2080 | 2100 | 12,500<br>12,810<br>14,380 | 83 |
| <b>MIDDLE KITTANNING (NO. 6) COAL</b> |             |      |   |             |                 |     |     |                      |                      |                     |                   |                      |                   |                      |                   |                      |                      |                      |     |      |      |      |                            |    |
| Belmont                               | Goshen      | 1403 | 3 | 2<br>3<br>4 | 37              | 1.3 | 1.9 | 42.1<br>43.0<br>47.4 | 46.8<br>47.7<br>52.6 | 9.2<br>9.4<br>5.8   | 5.4<br>5.2<br>5.8 | 72.2<br>73.6<br>81.2 | 1.4<br>1.4<br>1.5 | 8.1<br>6.6<br>7.3    | 3.8<br>3.9<br>4.3 | 0.03<br>0.03<br>0.03 | 1.97<br>2.01<br>2.22 | 1.78<br>1.81<br>2.00 | 4.5 | 1980 | 2080 | 2150 | 13,220<br>13,470<br>14,860 | 83 |
|                                       | Kirkwood    | 1398 | 3 | 2<br>3<br>4 | 39              | 1.2 | 1.9 | 38.2<br>39.0<br>49.3 | 39.4<br>40.1<br>50.7 | 20.5<br>20.9<br>6.1 | 4.9<br>4.8<br>6.1 | 62.0<br>63.2<br>79.9 | 1.1<br>1.2<br>1.5 | 7.7<br>6.1<br>7.7    | 3.7<br>3.8<br>4.8 | 0.03<br>0.03<br>0.04 | 2.26<br>2.30<br>2.91 | 1.46<br>1.49<br>1.88 | 4.5 | 2110 | 2250 | 2350 | 11,350<br>11,580<br>14,630 | 82 |
|                                       |             | 1406 | 3 | 2<br>3<br>4 | 31              | 1.2 | 2.3 | 35.6<br>36.4<br>47.7 | 39.0<br>39.9<br>52.3 | 23.2<br>23.7<br>5.8 | 4.6<br>4.4<br>5.8 | 59.3<br>60.7<br>79.6 | 1.0<br>1.0<br>1.3 | 7.6<br>5.7<br>7.5    | 4.3<br>4.4<br>5.8 | 0.07<br>0.07<br>0.09 | 2.95<br>3.02<br>3.96 | 1.29<br>1.32<br>1.73 | 4.0 | 2100 | 2190 | 2320 | 10,900<br>11,160<br>14,630 | 83 |
|                                       |             | 1428 | 3 | 2<br>3<br>4 | 35              | 0.3 | 1.9 | 40.9<br>41.7<br>46.7 | 46.7<br>47.7<br>53.3 | 10.4<br>10.6<br>5.7 | 5.2<br>5.1<br>5.7 | 70.7<br>72.1<br>80.7 | 1.2<br>1.3<br>1.4 | 8.5<br>6.9<br>7.7    | 3.9<br>4.0<br>4.4 | 0.06<br>0.06<br>0.07 | 2.14<br>2.18<br>2.44 | 1.69<br>1.72<br>1.93 | 5.0 | 2020 | 2120 | 2170 | 12,940<br>13,190<br>14,760 | 83 |
|                                       | Richland    | 1443 | 3 | 2<br>3<br>4 | 28              | 0.3 | 1.4 | 40.6<br>41.2<br>48.5 | 43.0<br>43.7<br>51.5 | 14.9<br>15.1<br>5.8 | 5.0<br>4.9<br>5.8 | 67.4<br>68.4<br>80.6 | 1.2<br>1.2<br>1.4 | 6.0<br>4.8<br>5.7    | 5.5<br>5.6<br>6.6 | 0.07<br>0.07<br>0.08 | 3.12<br>3.17<br>3.73 | 2.33<br>2.36<br>2.78 | 4.0 | 2000 | 2090 | 2160 | 12,410<br>12,590<br>14,830 | 83 |



| County                                     | Township    | DGS file no. | Kind | Condition | Analyzed thickness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                 |              | Ultimate analysis (%) |          |        |          |        | Forms of sulfur (%) |         |         | Free-swelling index | Fusibility of ash (°F) |                                 |                       | Heating value (Btu/lb) | Year   |                   |
|--|-------------|--------------|------|-----------|---------------------------------|--------------------|------------------------|-----------------|--------------|-----------------------|----------|--------|----------|--------|---------------------|---------|---------|---------------------|------------------------|---------------------------------|-----------------------|------------------------|--------|-------------------|
|  |             |              |      |           |                                 |                    | Moisture               | Volatile matter | Fixed carbon | Ash                   | Hydrogen | Carbon | Nitrogen | Oxygen | Total sulfur        | Sulfate | Pyritic |                     | Organic                | Initial deformation temperature | Softening temperature |                        |        | Fluid temperature |
| MIDDLE KITTANNING (NO. 6) COAL (continued) |             |              |      |           |                                 |                    |                        |                 |              |                       |          |        |          |        |                     |         |         |                     |                        |                                 |                       |                        |        |                   |
| Belmont (continued)                        | York        | 1413         | 3    | 2         | 36                              | 0.2                | 1.8                    | 40.3            | 49.5         | 8.5                   | 5.3      | 73.9   | 1.4      | 7.8    | 3.2                 | 0.06    | 1.54    | 1.59                | 6.0                    | 2000                            | 2160                  | 2220                   | 13,380 | 83                |
|  |             |              |      | 3         |                                 |                    |                        | 41.0            | 50.4         | 8.6                   | 5.2      | 75.2   | 1.4      | 6.3    | 3.2                 | 0.06    | 1.57    | 1.62                |                        |                                 |                       |                        | 13,610 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 44.9            | 55.1         |                       | 5.7      | 82.3   | 1.6      | 6.9    | 3.6                 | 0.07    | 1.72    | 1.77                |                        |                                 |                       |                        | 14,900 |                   |
| Gallia                                     | Morgan      | 1010         | 3    | 2         | 27                              | 5.8                | 8.1                    | 33.4            | 40.4         | 18.1                  | 5.0      | 58.9   | 1.0      | 15.5   | 1.4                 | 0.02    | 1.04    | 0.38                | 2.0                    | 2320                            | 2500                  | 2540                   | 10,480 | 82                |
|  |             |              |      | 3         |                                 |                    |                        | 36.4            | 43.9         | 19.7                  | 4.4      | 64.1   | 1.1      | 9.1    | 1.6                 | 0.02    | 1.13    | 0.41                |                        |                                 |                       |                        | 11,400 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 45.3            | 54.7         |                       | 5.5      | 79.9   | 1.4      | 11.3   | 2.0                 | 0.03    | 1.41    | 0.51                |                        |                                 |                       |                        | 14,190 |                   |
|  | Perry       | 1006         | 3    | 2         | 39                              | 6.2                | 9.1                    | 38.4            | 47.1         | 5.4                   | 5.8      | 69.0   | 1.3      | 17.0   | 1.4                 | 0.04    | 0.89    | 0.51                | 2.0                    | 2390                            | 2430                  | 2470                   | 12,270 | 82                |
|  |             |              |      | 3         |                                 |                    |                        | 42.2            | 51.9         | 5.9                   | 5.3      | 76.0   | 1.5      | 9.8    | 1.6                 | 0.04    | 0.98    | 0.56                |                        |                                 |                       |                        | 13,500 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 44.9            | 55.1         |                       | 5.6      | 80.8   | 1.6      | 10.4   | 1.7                 | 0.05    | 1.04    | 0.60                |                        |                                 |                       |                        | 14,360 |                   |
| Guernsey                                   | Adams       | 1484         | 3    | 2         | 48                              | 3.3                | 5.1                    | 42.4            | 44.2         | 8.3                   | 5.5      | 68.8   | 1.3      | 11.2   | 4.9                 | 0.01    | 2.48    | 2.39                | 4.0                    | 1970                            | 2080                  | 2130                   | 12,640 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 44.7            | 46.6         | 8.7                   | 5.2      | 72.5   | 1.3      | 7.0    | 5.1                 | 0.01    | 2.61    | 2.52                |                        |                                 |                       |                        | 13,320 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 48.9            | 51.1         |                       | 5.7      | 79.5   | 1.5      | 7.7    | 5.6                 | 0.01    | 2.86    | 2.76                |                        |                                 |                       |                        | 14,590 |                   |
|  | Jackson     | 1494         | 3    | 2         | 33                              | 2.8                | 4.3                    | 41.5            | 44.0         | 10.1                  | 5.3      | 68.7   | 1.4      | 11.5   | 3.0                 | 0.00    | 1.59    | 1.40                | 6.0                    | 2190                            | 2310                  | 2390                   | 12,460 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 43.4            | 46.0         | 10.6                  | 5.0      | 71.8   | 1.4      | 8.0    | 3.1                 | 0.00    | 1.66    | 1.46                |                        |                                 |                       |                        | 13,030 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 48.5            | 51.5         |                       | 5.6      | 80.2   | 1.6      | 9.0    | 3.5                 | 0.00    | 1.86    | 1.64                |                        |                                 |                       |                        | 14,560 |                   |
|  | Jefferson   | 1474         | 3    | 2         | 45                              | 0.6                | 2.3                    | 42.3            | 44.2         | 11.2                  | 5.4      | 69.1   | 1.2      | 8.5    | 4.5                 | 0.10    | 2.51    | 1.92                | 4.0                    | 1930                            | 2050                  | 2100                   | 12,660 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 43.3            | 45.2         | 11.5                  | 5.3      | 70.8   | 1.3      | 6.6    | 4.6                 | 0.10    | 2.57    | 1.97                |                        |                                 |                       |                        | 12,960 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 48.9            | 51.1         |                       | 6.0      | 79.9   | 1.4      | 7.4    | 5.2                 | 0.12    | 2.90    | 2.22                |                        |                                 |                       |                        | 14,640 |                   |
|  | Londonderry | 1464         | 3    | 2         | 33                              | 0.5                | 2.3                    | 36.2            | 39.6         | 21.9                  | 4.5      | 59.8   | 0.9      | 9.0    | 3.8                 | 0.07    | 1.88    | 1.89                | 4.5                    | 2250                            | 2360                  | 2400                   | 11,040 | 83                |
|  |             |              |      | 3         |                                 |                    |                        | 37.1            | 40.5         | 22.4                  | 4.4      | 61.2   | 1.0      | 7.2    | 3.9                 | 0.07    | 1.92    | 1.93                |                        |                                 |                       |                        | 11,290 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 47.8            | 52.2         |                       | 5.6      | 78.8   | 1.2      | 9.2    | 5.1                 | 0.09    | 2.48    | 2.49                |                        |                                 |                       |                        | 14,550 |                   |
|  | Monroe      | 1480         | 3    | 2         | 33                              | 4.5                | 6.6                    | 41.1            | 46.2         | 6.1                   | 5.7      | 71.0   | 1.2      | 12.4   | 3.5                 | 0.01    | 1.85    | 1.68                | 3.0                    | 1870                            | 2040                  | 2100                   | 12,840 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 44.0            | 49.5         | 6.6                   | 5.3      | 76.0   | 1.3      | 7.0    | 3.8                 | 0.01    | 1.98    | 1.80                |                        |                                 |                       |                        | 13,740 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 47.1            | 52.9         |                       | 5.7      | 81.4   | 1.4      | 7.5    | 4.1                 | 0.01    | 2.12    | 1.92                |                        |                                 |                       |                        | 14,710 |                   |
|  | Oxford      | 1453         | 3    | 2         | 39                              | 0.4                | 2.1                    | 38.6            | 41.5         | 17.8                  | 4.9      | 63.5   | 1.2      | 8.3    | 4.3                 | 0.11    | 2.09    | 2.07                | 5.5                    | 2200                            | 2400                  | 2520                   | 11,760 | 83                |
|  |             |              |      | 3         |                                 |                    |                        | 39.4            | 42.4         | 18.2                  | 4.8      | 64.9   | 1.2      | 6.5    | 4.4                 | 0.11    | 2.14    | 2.12                |                        |                                 |                       |                        | 12,020 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 48.2            | 51.8         |                       | 5.8      | 79.4   | 1.4      | 8.0    | 5.3                 | 0.14    | 2.61    | 2.59                |                        |                                 |                       |                        | 14,690 |                   |
|  | Richland    | 1504         | 3    | 2         | 42                              | 2.1                | 3.4                    | 39.8            | 40.5         | 16.3                  | 5.1      | 64.0   | 1.4      | 9.0    | 4.1                 | 0.02    | 2.42    | 1.67                | 4.0                    | 2160                            | 2240                  | 2580                   | 11,780 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 41.2            | 41.9         | 16.9                  | 4.9      | 66.2   | 1.4      | 6.3    | 4.3                 | 0.02    | 2.50    | 1.73                |                        |                                 |                       |                        | 12,190 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 49.6            | 50.4         |                       | 5.9      | 79.7   | 1.7      | 7.5    | 5.1                 | 0.02    | 3.01    | 2.08                |                        |                                 |                       |                        | 14,670 |                   |
|  | Spencer     | 1491         | 3    | 2         | 41                              | 2.3                | 4.4                    | 41.1            | 45.9         | 8.6                   | 5.5      | 69.5   | 1.2      | 10.6   | 4.7                 | 0.00    | 2.42    | 2.31                | 4.5                    | 1960                            | 2080                  | 2110                   | 12,660 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 43.0            | 48.0         | 9.0                   | 5.2      | 72.6   | 1.3      | 7.0    | 4.9                 | 0.00    | 2.53    | 2.42                |                        |                                 |                       |                        | 13,240 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 47.2            | 52.8         |                       | 5.7      | 79.8   | 1.4      | 7.7    | 5.4                 | 0.00    | 2.78    | 2.65                |                        |                                 |                       |                        | 14,540 |                   |
|  |             | 1499         | 3    | 2         | 39                              | 3.0                | 4.6                    | 40.6            | 45.9         | 8.9                   | 5.5      | 69.6   | 1.3      | 10.3   | 4.4                 | 0.01    | 2.82    | 1.55                | 4.0                    | 2000                            | 2090                  | 2290                   | 12,640 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 42.5            | 48.1         | 9.4                   | 5.3      | 72.9   | 1.3      | 6.5    | 4.6                 | 0.01    | 2.96    | 1.62                |                        |                                 |                       |                        | 13,250 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 46.9            | 53.1         |                       | 5.8      | 80.4   | 1.5      | 7.2    | 5.1                 | 0.01    | 3.26    | 1.79                |                        |                                 |                       |                        | 14,620 |                   |
|  | Washington  | 1472         | 3    | 2         | 42                              | 1.1                | 3.2                    | 39.0            | 45.3         | 12.6                  | 5.1      | 67.1   | 1.2      | 10.2   | 3.8                 | 0.09    | 2.01    | 1.66                | 3.5                    | 1970                            | 2070                  | 2110                   | 12,160 | 83                |
|  |             |              |      | 3         |                                 |                    |                        | 40.2            | 46.8         | 13.0                  | 5.0      | 69.4   | 1.2      | 7.6    | 3.9                 | 0.09    | 2.08    | 1.71                |                        |                                 |                       |                        | 12,560 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 46.2            | 53.8         |                       | 5.7      | 79.7   | 1.4      | 8.7    | 4.5                 | 0.11    | 2.39    | 1.97                |                        |                                 |                       |                        | 14,430 |                   |
|  | Westland    | 1487         | 3    | 2         | 26                              | 3.2                | 5.3                    | 39.2            | 44.1         | 11.3                  | 5.3      | 65.8   | 1.3      | 11.7   | 4.5                 | 0.01    | 2.52    | 2.01                | 2.0                    | 2000                            | 2150                  | 2220                   | 12,070 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 41.4            | 46.6         | 12.0                  | 5.0      | 69.5   | 1.4      | 7.4    | 4.8                 | 0.01    | 2.66    | 2.12                |                        |                                 |                       |                        | 12,740 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 47.1            | 52.9         |                       | 5.7      | 78.9   | 1.6      | 8.4    | 5.4                 | 0.01    | 3.02    | 2.41                |                        |                                 |                       |                        | 14,470 |                   |
|  | Wills       | 1477         | 3    | 2         | 40                              | 0.7                | 2.7                    | 40.9            | 42.7         | 13.6                  | 5.1      | 65.4   | 1.2      | 10.5   | 4.2                 | 0.07    | 2.38    | 1.74                | 4.0                    | 2110                            | 2180                  | 2430                   | 12,100 | 84                |
|  |             |              |      | 3         |                                 |                    |                        | 42.0            | 44.0         | 14.0                  | 4.9      | 67.2   | 1.3      | 8.3    | 4.3                 | 0.07    | 2.45    | 1.79                |                        |                                 |                       |                        | 12,440 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 48.9            | 51.1         |                       | 5.7      | 78.2   | 1.5      | 9.6    | 5.0                 | 0.08    | 2.85    | 2.08                |                        |                                 |                       |                        | 14,470 |                   |
| Stark                                      | Bethlehem   | 1416         | 2    | 2         | 49                              | 5.2                | 9.8                    | 35.5            | 46.1         | 8.6                   | 5.3      | 62.7   | 1.2      | 20.2   | 1.9                 | 0.20    | 0.27    | 1.44                | 0.5                    | 2090                            | 2170                  | 2230                   | 11,090 | 83                |
|  |             |              |      | 3         |                                 |                    |                        | 39.3            | 51.1         | 9.6                   | 4.7      | 69.5   | 1.3      | 12.8   | 2.1                 | 0.22    | 0.30    | 1.60                |                        |                                 |                       |                        | 12,290 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 43.5            | 56.5         |                       | 5.2      | 76.9   | 1.5      | 14.1   | 2.3                 | 0.25    | 0.33    | 1.76                |                        |                                 |                       |                        | 13,590 |                   |
| Tuscarawas                                 | Sandy       | 1448         | 2    | 2         | 36                              | 1.9                | 4.6                    | 41.3            | 45.0         | 9.0                   | 5.4      | 68.1   | 1.2      | 11.3   | 4.9                 | 0.34    | 2.42    | 2.18                | 3.0                    | 1880                            | 1990                  | 2030                   | 12,440 | 83                |
|  |             |              |      | 3         |                                 |                    |                        | 43.3            | 47.2         | 9.5                   | 5.1      | 71.4   | 1.3      | 7.5    | 5.2                 | 0.36    | 2.54    | 2.29                |                        |                                 |                       |                        | 13,040 |                   |
|  |             |              |      | 4         |                                 |                    |                        | 47.9            | 52.1         |                       | 5.7      | 78.9   | 1.4      | 8.3    | 5.7                 | 0.39    | 2.80    | 2.52                |                        |                                 |                       |                        | 14,400 |                   |

| LOWER FREEPORT (NO. 6A) COAL |              |      |   |   |    |     |     |      |      |      |     |      |     |      |      |      |      |      |     |      |      |      |        |    |
|------------------------------|--------------|------|---|---|----|-----|-----|------|------|------|-----|------|-----|------|------|------|------|------|-----|------|------|------|--------|----|
| Guernsey                     | Adams        | 1483 | 3 | 2 | 19 | 3.9 | 5.5 | 32.6 | 36.7 | 25.2 | 4.5 | 53.0 | 1.0 | 9.1  | 7.2  | 0.02 | 4.46 | 2.74 | 4.0 | 1970 | 2120 | 2160 | 9,790  | 84 |
|                              |              |      |   | 3 |    |     |     | 34.5 | 38.9 | 26.7 | 4.1 | 56.1 | 1.1 | 4.4  | 7.6  | 0.02 | 4.72 | 2.90 |     |      |      |      | 10,360 |    |
|                              |              |      |   | 4 |    |     |     | 47.0 | 53.0 |      | 5.6 | 76.5 | 1.4 | 6.1  | 10.4 | 0.03 | 6.44 | 3.95 |     |      |      |      | 14,130 |    |
|                              | Jackson      | 1493 | 3 | 2 | 25 | 3.0 | 4.3 | 41.1 | 39.7 | 14.9 | 5.3 | 64.4 | 1.2 | 9.7  | 4.5  | 0.00 | 3.26 | 1.21 | 3.5 | 1990 | 2070 | 2300 | 11,830 | 84 |
|                              |              |      |   | 3 |    |     |     | 43.0 | 41.5 | 15.6 | 5.1 | 67.3 | 1.3 | 6.2  | 4.7  | 0.00 | 3.41 | 1.26 |     |      |      |      | 12,360 |    |
|                              |              |      |   | 4 |    |     |     | 50.9 | 49.1 |      | 6.0 | 79.7 | 1.5 | 7.3  | 5.5  | 0.00 | 4.03 | 1.50 |     |      |      |      | 14,640 |    |
|                              | Londonderry  | 1463 | 3 | 2 | 34 | 0.5 | 2.1 | 40.8 | 43.7 | 13.3 | 5.1 | 67.0 | 1.3 | 8.5  | 4.9  | 0.05 | 2.46 | 2.36 | 4.5 | 1970 | 2060 | 2100 | 12,340 | 83 |
|                              |              |      |   | 3 |    |     |     | 41.7 | 44.7 | 13.6 | 4.9 | 68.5 | 1.3 | 6.7  | 5.0  | 0.05 | 2.51 | 2.41 |     |      |      |      | 12,610 |    |
|                              |              |      |   | 4 |    |     |     | 48.3 | 51.7 |      | 5.7 | 79.2 | 1.5 | 7.8  | 5.8  | 0.06 | 2.91 | 2.79 |     |      |      |      | 14,590 |    |
|                              | Oxford       | 1452 | 3 | 2 | 54 | 0.4 | 2.4 | 41.3 | 48.2 | 8.1  | 5.4 | 73.3 | 1.4 | 9.2  | 2.7  | 0.02 | 1.45 | 1.20 | 5.5 | 2030 | 2100 | 2360 | 13,310 | 83 |
|                              |              |      |   | 3 |    |     |     | 42.4 | 49.3 | 8.3  | 5.3 | 75.0 | 1.4 | 7.2  | 2.7  | 0.02 | 1.49 | 1.23 |     |      |      |      | 13,640 |    |
|                              |              |      |   | 4 |    |     |     | 46.2 | 53.8 |      | 5.8 | 81.8 | 1.5 | 7.9  | 3.0  | 0.02 | 1.62 | 1.34 |     |      |      |      | 14,870 |    |
|                              | Richland     | 1503 | 3 | 2 | 27 | 2.4 | 3.7 | 40.7 | 44.1 | 11.5 | 5.3 | 67.9 | 1.5 | 8.1  | 5.7  | 0.03 | 3.86 | 1.83 | 5.0 | 2060 | 2090 | 2380 | 12,430 | 84 |
|                              |              |      |   | 3 |    |     |     | 42.3 | 45.8 | 11.9 | 5.0 | 70.5 | 1.6 | 5.0  | 5.9  | 0.03 | 4.01 | 1.90 |     |      |      |      | 12,910 |    |
|                              |              |      |   | 4 |    |     |     | 48.0 | 52.0 |      | 5.7 | 80.1 | 1.8 | 5.7  | 6.7  | 0.04 | 4.55 | 2.16 |     |      |      |      | 14,650 |    |
|                              | Spencer      | 1490 | 3 | 2 | 17 | 3.8 | 5.6 | 32.5 | 41.4 | 20.5 | 4.6 | 59.2 | 0.9 | 9.6  | 5.1  | 0.01 | 3.04 | 2.08 | 3.5 | 2000 | 2140 | 2170 | 10,620 | 84 |
|                              |              |      |   | 3 |    |     |     | 34.4 | 43.8 | 21.8 | 4.2 | 62.7 | 1.0 | 4.9  | 5.4  | 0.01 | 3.22 | 2.20 |     |      |      |      | 11,250 |    |
|                              |              |      |   | 4 |    |     |     | 44.0 | 56.0 |      | 5.3 | 80.2 | 1.2 | 6.3  | 6.9  | 0.01 | 4.12 | 2.82 |     |      |      |      | 14,380 |    |
|                              |              | 1498 | 3 | 2 | 25 | 3.5 | 4.9 | 36.9 | 42.5 | 15.8 | 5.0 | 63.1 | 1.1 | 11.1 | 3.9  | 0.01 | 2.74 | 1.18 | 4.0 | 2080 | 2160 | 2320 | 11,450 | 84 |
|                              |              |      |   | 3 |    |     |     | 38.8 | 44.7 | 16.6 | 4.7 | 66.3 | 1.2 | 7.1  | 4.1  | 0.01 | 2.88 | 1.24 |     |      |      |      | 12,040 |    |
|                              |              |      |   | 4 |    |     |     | 46.5 | 53.5 |      | 5.6 | 79.5 | 1.4 | 8.5  | 5.0  | 0.01 | 3.45 | 1.49 |     |      |      |      | 14,430 |    |
|                              | Valley       | 1482 | 3 | 2 | 33 | 3.7 | 5.6 | 40.0 | 46.0 | 8.5  | 5.4 | 69.1 | 1.2 | 11.8 | 4.0  | 0.02 | 2.22 | 1.78 | 2.5 | 1970 | 2100 | 2150 | 12,590 | 84 |
|                              |              |      |   | 3 |    |     |     | 42.3 | 48.7 | 9.0  | 5.1 | 73.2 | 1.3 | 7.2  | 4.3  | 0.02 | 2.35 | 1.88 |     |      |      |      | 13,330 |    |
|                              |              |      |   | 4 |    |     |     | 46.5 | 53.5 |      | 5.6 | 80.4 | 1.4 | 7.9  | 4.7  | 0.02 | 2.58 | 2.07 |     |      |      |      | 14,640 |    |
|                              | Washington   | 1471 | 3 | 2 | 15 | 0.5 | 2.3 | 38.0 | 41.2 | 18.5 | 4.8 | 61.7 | 1.1 | 7.8  | 6.1  | 0.11 | 3.49 | 2.53 | 3.5 | 1970 | 2100 | 2140 | 11,410 | 83 |
|                              |              |      |   | 3 |    |     |     | 38.9 | 42.2 | 18.9 | 4.7 | 63.1 | 1.1 | 5.9  | 6.3  | 0.11 | 3.57 | 2.59 |     |      |      |      | 11,680 |    |
|                              |              |      |   | 4 |    |     |     | 48.0 | 52.0 |      | 5.8 | 77.9 | 1.3 | 7.3  | 7.7  | 0.14 | 4.41 | 3.19 |     |      |      |      | 14,400 |    |
| Jefferson                    | Springfield  | 1444 | 2 | 2 | 37 | 1.9 | 3.6 | 38.4 | 47.8 | 10.2 | 5.4 | 69.8 | 1.3 | 10.0 | 3.3  | 0.22 | 1.70 | 1.34 | 5.5 | 1910 | 2020 | 2340 | 12,640 | 83 |
|                              |              |      | 3 | 3 |    |     |     | 39.8 | 49.6 | 10.6 | 5.2 | 72.4 | 1.4 | 7.0  | 3.4  | 0.23 | 1.76 | 1.39 |     |      |      |      | 13,120 |    |
|                              |              |      | 4 | 4 |    |     |     | 44.5 | 55.5 |      | 5.8 | 81.0 | 1.5 | 7.9  | 3.8  | 0.26 | 1.97 | 1.55 |     |      |      |      | 14,670 |    |
| Stark                        | Osnaburg     | 1421 | 2 | 2 | 23 | 2.2 | 5.2 | 33.4 | 43.5 | 17.8 | 5.1 | 60.7 | 1.1 | 12.8 | 2.4  | 0.18 | 1.14 | 1.09 | 1.0 | 2330 | 2450 | 2500 | 10,850 | 83 |
|                              |              |      | 3 | 3 |    |     |     | 35.3 | 45.9 | 18.8 | 4.7 | 64.1 | 1.2 | 8.6  | 2.5  | 0.19 | 1.20 | 1.15 |     |      |      |      | 11,450 |    |
|                              |              |      | 4 | 4 |    |     |     | 43.5 | 56.5 |      | 5.8 | 79.0 | 1.5 | 10.6 | 3.1  | 0.23 | 1.48 | 1.42 |     |      |      |      | 14,110 |    |
| UPPER FREEPORT (NO. 7) COAL  |              |      |   |   |    |     |     |      |      |      |     |      |     |      |      |      |      |      |     |      |      |      |        |    |
| Belmont                      | Kirkwood     | 1399 | 3 | 2 | 62 | 1.6 | 2.6 | 37.1 | 47.3 | 13.0 | 5.0 | 68.5 | 1.3 | 8.6  | 3.6  | 0.05 | 2.42 | 1.09 | 5.5 | 2050 | 2140 | 2180 | 12,350 | 82 |
|                              |              |      |   | 3 |    |     |     | 38.1 | 48.5 | 13.4 | 4.8 | 70.4 | 1.3 | 6.4  | 3.7  | 0.05 | 2.49 | 1.12 |     |      |      |      | 12,680 |    |
|                              |              |      |   | 4 |    |     |     | 44.0 | 56.0 |      | 5.5 | 81.3 | 1.6 | 7.4  | 4.2  | 0.06 | 2.87 | 1.29 |     |      |      |      | 14,650 |    |
|                              |              | 1427 | 3 | 2 | 55 | 0.4 | 1.9 | 33.4 | 43.2 | 21.4 | 4.3 | 60.8 | 1.1 | 8.6  | 3.7  | 0.06 | 2.48 | 1.13 | 5.0 | 2210 | 2340 | 2430 | 11,000 | 83 |
|                              |              |      |   | 3 |    |     |     | 34.1 | 44.1 | 21.8 | 4.2 | 62.0 | 1.2 | 7.1  | 3.7  | 0.06 | 2.53 | 1.15 |     |      |      |      | 11,210 |    |
|                              |              |      |   | 4 |    |     |     | 43.6 | 56.4 |      | 5.4 | 79.3 | 1.5 | 9.0  | 4.8  | 0.08 | 3.23 | 1.47 |     |      |      |      | 14,340 |    |
|                              | York         | 1412 | 3 | 2 | 21 | 0.3 | 1.6 | 33.2 | 39.8 | 25.4 | 4.2 | 56.9 | 1.1 | 6.4  | 6.0  | 0.19 | 3.29 | 2.54 | 4.5 | 2020 | 2180 | 2230 | 10,470 | 83 |
|                              |              |      |   | 3 |    |     |     | 33.7 | 40.5 | 25.8 | 4.1 | 57.8 | 1.1 | 5.1  | 6.1  | 0.19 | 3.34 | 2.58 |     |      |      |      | 10,640 |    |
|                              |              |      |   | 4 |    |     |     | 45.5 | 54.5 |      | 5.5 | 77.9 | 1.5 | 6.9  | 8.2  | 0.26 | 4.51 | 3.48 |     |      |      |      | 14,340 |    |
| Columbiana                   | Butler       | 1439 | 2 | 2 | 50 | 1.1 | 3.3 | 36.6 | 41.4 | 18.8 | 4.7 | 60.9 | 1.2 | 10.1 | 4.4  | 0.26 | 2.34 | 1.76 | 2.5 | 2100 | 2190 | 2420 | 11,160 | 83 |
|                              |              |      | 3 | 3 |    |     |     | 37.8 | 42.8 | 19.4 | 4.5 | 63.0 | 1.2 | 7.4  | 4.5  | 0.27 | 2.42 | 1.82 |     |      |      |      | 11,540 |    |
|                              |              |      | 4 | 4 |    |     |     | 46.9 | 53.1 |      | 5.6 | 78.1 | 1.5 | 9.2  | 5.6  | 0.33 | 3.00 | 2.26 |     |      |      |      | 14,320 |    |
|                              | Elk Run      | 1466 | 2 | 2 | 36 | 3.4 | 5.4 | 34.3 | 53.2 | 7.0  | 5.2 | 71.7 | 1.3 | 11.8 | 2.9  | 0.18 | 1.52 | 1.20 | 7.5 | 1990 | 2140 | 2200 | 12,780 | 83 |
|                              |              |      |   | 3 |    |     |     | 36.3 | 56.3 | 7.4  | 4.9 | 75.8 | 1.4 | 7.4  | 3.1  | 0.19 | 1.61 | 1.27 |     |      |      |      | 13,500 |    |
|                              |              |      |   | 4 |    |     |     | 39.2 | 60.8 |      | 5.3 | 81.9 | 1.5 | 8.0  | 3.3  | 0.21 | 1.74 | 1.37 |     |      |      |      | 14,590 |    |
|                              | Hanover      | 1441 | 2 | 2 | 39 | 2.3 | 4.9 | 35.8 | 46.7 | 12.5 | 5.1 | 65.8 | 1.4 | 11.8 | 3.4  | 0.33 | 1.54 | 1.53 | 4.0 | 2090 | 2210 | 2280 | 11,890 | 83 |
|                              |              |      |   | 3 |    |     |     | 37.7 | 49.2 | 13.1 | 4.8 | 69.2 | 1.5 | 7.8  | 3.6  | 0.35 | 1.62 | 1.61 |     |      |      |      | 12,500 |    |
|                              |              |      |   | 4 |    |     |     | 43.4 | 56.6 |      | 5.6 | 79.6 | 1.7 | 9.0  | 4.1  | 0.40 | 1.86 | 1.85 |     |      |      |      | 14,390 |    |
|                              | Middleton    | 1456 | 2 | 2 | 27 | 1.3 | 3.5 | 36.3 | 54.3 | 5.9  | 5.4 | 75.6 | 1.4 | 10.2 | 1.5  | 0.17 | 0.81 | 0.50 | 6.5 | 2120 | 2280 | 2350 | 13,490 | 83 |
|                              |              |      |   | 3 |    |     |     | 37.6 | 56.3 | 6.1  | 5.2 | 78.4 | 1.5 | 7.3  | 1.5  | 0.18 | 0.84 | 0.52 |     |      |      |      | 13,980 |    |
|                              |              |      |   | 4 |    |     |     | 40.0 | 60.0 |      | 5.6 | 83.5 | 1.6 | 7.7  | 1.6  | 0.19 | 0.89 | 0.55 |     |      |      |      | 14,890 |    |
|                              | Yellow Creek | 1451 | 2 | 2 | 41 | 3.6 | 5.8 | 35.5 | 49.0 | 9.7  | 5.3 | 70.1 | 1.3 | 11.0 | 2.5  | 0.26 | 1.32 | 0.92 | 7.5 | 2150 | 2320 | 2390 | 12,510 | 83 |
|                              |              |      |   | 3 |    |     |     | 37.7 | 52.0 | 10.3 | 5.0 | 74.5 | 1.4 | 6.2  | 2.7  | 0.28 | 1.40 | 0.98 |     |      |      |      | 13,280 |    |
|                              |              |      |   | 4 |    |     |     | 42.0 | 58.0 |      | 5.5 | 83.0 | 1.6 | 6.9  | 3.0  | 0.31 | 1.56 | 1.09 |     |      |      |      | 14,800 |    |



| County                                  | Township    | DGS file no. | Kind | Condition | Analyzed thickness (nearest in) | Air-dried loss (%) | Proximate analysis (%) |                 |              | Ultimate analysis (%) |          |        |          |        |              | Forms of sulfur (%) |         |         | Free-swelling index | Fusibility of ash (°F)          |                       |                   | Heating value (Btu/lb) | Year |
|---|-------------|--------------|------|-----------|---------------------------------|--------------------|------------------------|-----------------|--------------|-----------------------|----------|--------|----------|--------|--------------|---------------------|---------|---------|---------------------|---------------------------------|-----------------------|-------------------|------------------------|------|
|   |             |              |      |           |                                 |                    | Moisture               | Volatile matter | Fixed carbon | Ash                   | Hydrogen | Carbon | Nitrogen | Oxygen | Total sulfur | Sulfate             | Pyritic | Organic |                     | Initial deformation temperature | Softening temperature | Fluid temperature |                        |      |
| UPPER FREEPORT (NO. 7) COAL (continued) |             |              |      |           |                                 |                    |                        |                 |              |                       |          |        |          |        |              |                     |         |         |                     |                                 |                       |                   |                        |      |
| Guernsey                                | Jackson     | 1492         | 3    | 2         | 69                              | 5.1                | 7.0                    | 35.2            | 49.7         | 8.1                   | 5.6      | 69.5   | 1.3      | 14.1   | 1.4          | 0.00                | 0.90    | 0.49    | 5.5                 | 2610                            | 2680                  | 2750              | 12,470                 | 84   |
|   |             |              |      | 3         |                                 |                    |                        | 37.8            | 53.4         | 8.7                   | 5.2      | 74.7   | 1.4      | 8.4    | 1.5          | 0.00                | 0.97    | 0.53    |                     |                                 |                       |                   | 13,420                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 41.5            | 58.5         | 5.7                   | 5.7      | 81.9   | 1.6      | 9.2    | 1.6          | 0.00                | 1.06    | 0.58    |                     |                                 |                       |                   | 14,700                 |      |
|   | Londonderry | 1459         | 3    | 2         | 31                              | 1.3                | 3.5                    | 33.9            | 46.8         | 15.8                  | 4.6      | 63.9   | 1.2      | 9.5    | 4.9          | 0.29                | 2.64    | 1.93    | 3.5                 | 1950                            | 2020                  | 2060              | 11,620                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 35.1            | 48.5         | 16.4                  | 4.4      | 66.2   | 1.3      | 6.7    | 5.0          | 0.30                | 2.73    | 2.00    |                     |                                 |                       |                   | 12,030                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 42.0            | 58.0         | 5.3                   | 79.2     | 1.5    | 8.0      | 6.0    | 0.36         | 3.27                | 2.39    | 14,400  |                     |                                 |                       |                   |                        |      |
|   | Spencer     | 1497         | 3    | 2         | 25                              | 3.5                | 4.8                    | 36.6            | 44.3         | 14.3                  | 5.1      | 64.9   | 1.2      | 11.4   | 3.1          | 0.01                | 2.41    | 0.69    | 5.5                 | 2100                            | 2180                  | 2320              | 11,740                 | 84   |
|   |             |              |      | 3         |                                 |                    |                        | 38.4            | 46.6         | 15.0                  | 4.8      | 68.1   | 1.3      | 7.5    | 3.3          | 0.01                | 2.53    | 0.72    |                     |                                 |                       |                   | 12,340                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 45.2            | 54.8         | 5.6                   | 80.2     | 1.5    | 8.8      | 3.8    | 0.01         | 2.98                | 0.85    | 14,510  |                     |                                 |                       |                   |                        |      |
| Harrison                                | Monroe      | 1455         | 2    | 2         | 46                              | 4.0                | 7.2                    | 36.4            | 47.1         | 9.3                   | 5.4      | 66.8   | 1.3      | 14.0   | 3.1          | 0.32                | 1.65    | 1.18    | 5.5                 | 1990                            | 2080                  | 2130              | 12,050                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 39.2            | 50.8         | 10.0                  | 5.0      | 72.0   | 1.4      | 8.2    | 3.4          | 0.34                | 1.78    | 1.27    |                     |                                 |                       |                   | 12,980                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 43.6            | 56.4         | 5.5                   | 80.0     | 1.6    | 9.2      | 3.8    | 0.38         | 1.98                | 1.41    | 14,420  |                     |                                 |                       |                   |                        |      |
| Jefferson                               | Ross        | 1445         | 2    | 2         | 34                              | 1.2                | 3.3                    | 37.7            | 52.4         | 6.6                   | 5.3      | 73.9   | 1.4      | 9.7    | 3.0          | 0.10                | 1.70    | 1.16    | 6.5                 | 2000                            | 2100                  | 2430              | 13,260                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 39.0            | 54.2         | 6.9                   | 5.1      | 76.4   | 1.5      | 7.1    | 3.1          | 0.10                | 1.76    | 1.20    |                     |                                 |                       |                   | 13,710                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 41.8            | 58.2         | 5.5                   | 82.0     | 1.6    | 7.6      | 3.3    | 0.11         | 1.89                | 1.29    | 14,720  |                     |                                 |                       |                   |                        |      |
| Muskingum                               | Wayne       | 1359         | 2    | 2         | 47 <sup>3</sup>                 | 4.3                | 6.0                    | 35.8            | 42.1         | 16.0                  | 5.0      | 60.7   | 1.1      | 12.5   | 4.6          | 0.17                | 2.94    | 1.51    | 3.5                 | 2060                            | 2150                  | 2240              | 10,910                 | 82   |
|   |             |              |      | 3         |                                 |                    |                        | 38.2            | 44.8         | 17.1                  | 4.6      | 64.6   | 1.2      | 7.6    | 4.9          | 0.18                | 3.13    | 1.61    |                     |                                 |                       |                   | 11,620                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 46.0            | 54.0         | 5.5                   | 77.9     | 1.5    | 9.2      | 5.9    | 0.22         | 3.77                | 1.94    | 14,000  |                     |                                 |                       |                   |                        |      |
| Stark                                   | Paris       | 1432         | 2    | 2         | 28                              | 2.5                | 6.6                    | 32.5            | 49.3         | 11.6                  | 5.2      | 65.8   | 1.4      | 14.3   | 1.7          | 0.11                | 1.05    | 0.54    | 2.5                 | 2010                            | 2080                  | 2130              | 11,650                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 34.8            | 52.8         | 12.4                  | 4.8      | 70.4   | 1.5      | 9.0    | 1.8          | 0.12                | 1.12    | 0.58    |                     |                                 |                       |                   | 12,470                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 39.7            | 60.3         | 5.5                   | 80.5     | 1.7    | 10.3     | 2.1    | 0.13         | 1.28                | 0.66    | 14,240  |                     |                                 |                       |                   |                        |      |
| MAHONING COAL                           |             |              |      |           |                                 |                    |                        |                 |              |                       |          |        |          |        |              |                     |         |         |                     |                                 |                       |                   |                        |      |
| Columbiana                              | Center      | 1440         | 2    | 2         | 19                              | 4.0                | 7.1                    | 33.9            | 49.9         | 9.0                   | 5.4      | 68.4   | 1.5      | 14.3   | 1.4          | 0.30                | 0.62    | 0.51    | 6.5                 | 2170                            | 2270                  | 2350              | 12,150                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 36.6            | 53.7         | 9.7                   | 4.9      | 73.7   | 1.6      | 8.5    | 1.5          | 0.32                | 0.67    | 0.55    |                     |                                 |                       |                   | 13,090                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 40.5            | 59.5         | 5.5                   | 81.6     | 1.8    | 9.4      | 1.7    | 0.36         | 0.74                | 0.61    | 14,490  |                     |                                 |                       |                   |                        |      |
|   | Elk Run     | 1467         | 2    | 2         | 21                              | 2.6                | 4.8                    | 33.2            | 50.8         | 11.2                  | 5.1      | 69.6   | 1.4      | 11.1   | 1.5          | 0.21                | 0.72    | 0.58    | 5.0                 | 2340                            | 2460                  | 2510              | 12,400                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 34.9            | 53.3         | 11.8                  | 4.8      | 73.1   | 1.5      | 7.2    | 1.6          | 0.22                | 0.76    | 0.61    |                     |                                 |                       |                   | 13,020                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 39.5            | 60.5         | 5.5                   | 82.9     | 1.7    | 8.1      | 1.8    | 0.25         | 0.86                | 0.69    | 14,760  |                     |                                 |                       |                   |                        |      |
|   | Hanover     | 1442         | 2    | 2         | 16                              | 1.2                | 4.1                    | 35.6            | 50.6         | 9.8                   | 5.2      | 70.6   | 1.6      | 11.5   | 1.2          | 0.08                | 0.73    | 0.44    | 4.5                 | 2280                            | 2410                  | 2420              | 12,580                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 37.1            | 52.7         | 10.2                  | 5.0      | 73.7   | 1.7      | 8.2    | 1.3          | 0.08                | 0.76    | 0.46    |                     |                                 |                       |                   | 13,120                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 41.3            | 58.7         | 5.5                   | 82.0     | 1.9    | 9.1      | 1.5    | 0.09         | 0.85                | 0.51    | 14,610  |                     |                                 |                       |                   |                        |      |
|   | Madison     | 1457         | 2    | 2         | 37                              | 1.0                | 2.9                    | 35.6            | 49.6         | 11.8                  | 5.0      | 69.2   | 1.4      | 9.3    | 3.3          | 0.23                | 2.00    | 1.09    | 4.5                 | 2050                            | 2140                  | 2180              | 12,690                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 36.7            | 51.1         | 12.1                  | 4.9      | 71.3   | 1.4      | 6.8    | 3.4          | 0.24                | 2.06    | 1.12    |                     |                                 |                       |                   | 13,080                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 41.8            | 58.2         | 5.5                   | 81.2     | 1.6    | 7.8      | 3.9    | 0.27         | 2.35                | 1.28    | 14,880  |                     |                                 |                       |                   |                        |      |
|   |             | 1458         | 2    | 2         | 36                              | 1.1                | 2.9                    | 37.2            | 50.3         | 9.5                   | 5.3      | 71.5   | 1.5      | 9.4    | 2.8          | 0.17                | 1.57    | 1.06    | 5.5                 | 2130                            | 2220                  | 2250              | 13,030                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 38.4            | 51.8         | 9.8                   | 5.1      | 73.6   | 1.5      | 7.0    | 2.9          | 0.18                | 1.62    | 1.09    |                     |                                 |                       |                   | 13,430                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 42.5            | 57.5         | 5.7                   | 81.6     | 1.7    | 7.8      | 3.2    | 0.19         | 1.79                | 1.21    | 14,890  |                     |                                 |                       |                   |                        |      |
| Jefferson                               | Ross        | 1446         | 2    | 2         | 27                              | 7.7                | 11.4                   | 29.9            | 45.6         | 13.0                  | 5.2      | 59.2   | 1.2      | 20.5   | 0.9          | 0.06                | 0.08    | 0.76    | 0.0                 | 2120                            | 2220                  | 2480              | 10,370                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 33.7            | 51.5         | 14.7                  | 4.4      | 66.8   | 1.3      | 11.7   | 1.0          | 0.07                | 0.09    | 0.86    |                     |                                 |                       |                   | 11,710                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 39.6            | 60.4         | 5.2                   | 78.4     | 1.6    | 13.7     | 1.2    | 0.08         | 0.11                | 1.01    | 13,740  |                     |                                 |                       |                   |                        |      |
| WILGUS COAL                             |             |              |      |           |                                 |                    |                        |                 |              |                       |          |        |          |        |              |                     |         |         |                     |                                 |                       |                   |                        |      |
| Guernsey                                | Oxford      | 1460         | 3    | 2         | 15                              | 0.5                | 2.2                    | 38.1            | 43.0         | 16.8                  | 4.9      | 63.7   | 1.2      | 7.9    | 5.6          | 0.08                | 2.79    | 2.74    | 6.5                 | 2030                            | 2110                  | 2140              | 11,690                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 38.9            | 43.9         | 17.2                  | 4.7      | 65.1   | 1.2      | 6.1    | 5.7          | 0.08                | 2.85    | 2.80    |                     |                                 |                       |                   | 11,950                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 47.0            | 53.0         | 5.7                   | 5.7      | 78.6   | 1.4      | 7.4    | 6.9          | 0.10                | 3.44    | 3.38    |                     |                                 |                       |                   | 14,430                 |      |
| ANDERSON COAL                           |             |              |      |           |                                 |                    |                        |                 |              |                       |          |        |          |        |              |                     |         |         |                     |                                 |                       |                   |                        |      |
| Belmont                                 | Goshen      | 1402         | 3    | 2         | 20                              | 1.3                | 2.3                    | 38.8            | 44.2         | 14.7                  | 4.9      | 66.7   | 1.3      | 7.0    | 5.4          | 0.06                | 3.46    | 1.89    | 5.0                 | 1910                            | 1990                  | 2030              | 12,220                 | 83   |
|   |             |              |      | 3         |                                 |                    |                        | 39.7            | 45.2         | 15.1                  | 4.7      | 68.3   | 1.3      | 5.1    | 5.5          | 0.06                | 3.54    | 1.93    |                     |                                 |                       |                   | 12,510                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 46.8            | 53.2         | 5.6                   | 80.4     | 1.5    | 6.0      | 6.5    | 0.07         | 4.17                | 2.28    | 14,730  |                     |                                 |                       |                   |                        |      |
|   | Kirkwood    | 1396         | 3    | 2         | 36                              | 1.9                | 2.7                    | 34.8            | 42.5         | 20.0                  | 4.7      | 62.6   | 1.2      | 8.7    | 2.9          | 0.04                | 1.65    | 1.17    | 4.0                 | 2170                            | 2300                  | 2370              | 11,230                 | 82   |
|   |             |              |      | 3         |                                 |                    |                        | 35.8            | 43.6         | 20.6                  | 4.5      | 64.3   | 1.2      | 6.5    | 2.9          | 0.04                | 1.70    | 1.20    |                     |                                 |                       |                   | 11,540                 |      |
|   |             |              |      | 4         |                                 |                    |                        | 45.0            | 55.0         | 5.6                   | 81.0     | 1.5    | 8.2      | 3.7    | 0.05         | 2.14                | 1.51    | 14,530  |                     |                                 |                       |                   |                        |      |



|                                 |           |      |   |             |    |     |     |                      |                      |                     |                   |                      |                   |                    |                   |                      |                      |                      |     |      |      |      |                            |    |
|---------------------------------|-----------|------|---|-------------|----|-----|-----|----------------------|----------------------|---------------------|-------------------|----------------------|-------------------|--------------------|-------------------|----------------------|----------------------|----------------------|-----|------|------|------|----------------------------|----|
| Guernsey                        | York      | 1410 | 3 | 2<br>3<br>4 | 19 | 1.6 | 2.8 | 37.5<br>38.6<br>43.9 | 47.9<br>49.3<br>56.1 | 11.8<br>12.1<br>5.4 | 5.0<br>4.8<br>5.4 | 69.6<br>71.7<br>81.5 | 1.2<br>1.2<br>1.4 | 9.1<br>6.8<br>7.7  | 3.4<br>3.5<br>4.0 | 0.04<br>0.04<br>0.05 | 1.86<br>1.91<br>2.18 | 1.50<br>1.54<br>1.76 | 5.5 | 2100 | 2250 | 2390 | 12,520<br>12,880<br>14,660 | 83 |
|                                 |           | 1426 | 3 | 2<br>3<br>4 | 27 | 0.4 | 1.8 | 36.0<br>36.6<br>45.3 | 43.4<br>44.2<br>54.7 | 18.8<br>19.2<br>5.6 | 4.6<br>4.5<br>5.6 | 63.2<br>64.4<br>79.6 | 1.2<br>1.2<br>1.5 | 7.4<br>5.9<br>7.3  | 4.8<br>4.9<br>6.0 | 0.05<br>0.05<br>0.06 | 2.83<br>2.88<br>3.57 | 1.92<br>1.96<br>2.42 | 3.0 | 2100 | 2190 | 2230 | 11,500<br>11,710<br>14,490 | 83 |
|                                 |           | 1411 | 3 | 2<br>3<br>4 | 18 | 0.2 | 1.9 | 35.6<br>36.3<br>40.6 | 52.2<br>53.2<br>59.4 | 10.2<br>10.4<br>5.5 | 5.1<br>4.9<br>5.5 | 72.5<br>73.9<br>82.5 | 1.5<br>1.5<br>1.7 | 9.8<br>8.2<br>9.2  | 0.9<br>1.0<br>1.1 | 0.02<br>0.02<br>0.02 | 0.15<br>0.15<br>0.17 | 0.77<br>0.78<br>0.88 | 5.0 | 2800 | 2800 | 2800 | 12,910<br>13,160<br>14,690 | 83 |
|                                 |           | 1489 | 3 | 2<br>3<br>4 | 26 | 3.9 | 6.0 | 37.9<br>40.4<br>46.3 | 44.1<br>46.9<br>53.7 | 11.9<br>12.7<br>5.6 | 5.2<br>4.9<br>5.6 | 65.9<br>70.1<br>80.3 | 1.3<br>1.4<br>1.6 | 13.1<br>8.3<br>9.5 | 2.5<br>2.7<br>3.0 | 0.01<br>0.01<br>0.01 | 1.14<br>1.21<br>1.39 | 1.35<br>1.44<br>1.65 | 4.0 | 2090 | 2260 | 2300 | 11,780<br>12,530<br>14,350 | 84 |
|                                 |           | 1496 | 3 | 2<br>3<br>4 | 33 | 4.5 | 5.7 | 39.1<br>41.5<br>47.5 | 43.3<br>46.0<br>52.5 | 11.8<br>12.5<br>5.7 | 5.3<br>5.0<br>5.7 | 65.0<br>68.9<br>78.8 | 1.2<br>1.2<br>1.4 | 12.2<br>7.6<br>8.7 | 4.4<br>4.7<br>5.3 | 0.01<br>0.01<br>0.01 | 2.73<br>2.89<br>3.31 | 1.65<br>1.75<br>2.00 | 5.0 | 1990 | 2130 | 2280 | 11,770<br>12,480<br>14,270 | 84 |
| <b>HARLEM COAL</b>              |           |      |   |             |    |     |     |                      |                      |                     |                   |                      |                   |                    |                   |                      |                      |                      |     |      |      |      |                            |    |
| Carroll                         | Lee       | 1450 | 2 | 2<br>3<br>4 | 32 | 3.4 | 6.3 | 35.4<br>37.8<br>41.2 | 50.5<br>53.9<br>58.8 | 7.8<br>8.3<br>5.5   | 5.5<br>5.1<br>5.5 | 70.6<br>75.3<br>82.1 | 1.5<br>1.6<br>1.7 | 13.4<br>8.3<br>9.1 | 1.3<br>1.3<br>1.5 | 0.13<br>0.14<br>0.15 | 0.62<br>0.66<br>0.72 | 0.51<br>0.54<br>0.59 | 5.5 | 2210 | 2320 | 2530 | 12,560<br>13,400<br>14,620 | 83 |
| <b>PITTSBURGH (NO. 8) COAL</b>  |           |      |   |             |    |     |     |                      |                      |                     |                   |                      |                   |                    |                   |                      |                      |                      |     |      |      |      |                            |    |
| Belmont                         | Goshen    | 1401 | 3 | 2<br>3<br>4 | 80 | 0.7 | 2.0 | 40.6<br>41.5<br>47.1 | 45.7<br>46.6<br>52.9 | 11.7<br>11.9<br>5.8 | 5.2<br>5.1<br>5.8 | 69.4<br>70.8<br>80.4 | 1.3<br>1.3<br>1.5 | 7.6<br>5.9<br>6.7  | 4.8<br>4.9<br>5.6 | 0.05<br>0.05<br>0.06 | 2.90<br>2.96<br>3.36 | 1.86<br>1.90<br>2.16 | 5.5 | 1970 | 2060 | 2350 | 12,750<br>13,010<br>14,780 | 83 |
| <b>MEIGS CREEK (NO. 9) COAL</b> |           |      |   |             |    |     |     |                      |                      |                     |                   |                      |                   |                    |                   |                      |                      |                      |     |      |      |      |                            |    |
| Belmont                         | Goshen    | 1400 | 3 | 2<br>3<br>4 | 47 | 1.8 | 2.8 | 38.2<br>39.3<br>46.9 | 43.2<br>44.5<br>53.1 | 15.8<br>16.2<br>5.5 | 4.8<br>4.6<br>5.5 | 65.8<br>67.7<br>80.8 | 1.2<br>1.3<br>1.5 | 8.0<br>5.7<br>6.8  | 4.3<br>4.4<br>5.3 | 0.01<br>0.01<br>0.01 | 2.35<br>2.42<br>2.89 | 1.94<br>2.00<br>2.38 | 5.0 | 2000 | 2060 | 2100 | 11,860<br>12,200<br>14,560 | 83 |
| <b>NOT DESIGNATED</b>           |           |      |   |             |    |     |     |                      |                      |                     |                   |                      |                   |                    |                   |                      |                      |                      |     |      |      |      |                            |    |
| Belmont                         | York      | 1462 | 3 | 2<br>3<br>4 | 22 | 0.3 | 1.5 | 38.0<br>38.6<br>43.8 | 48.8<br>49.6<br>56.2 | 11.6<br>11.8<br>5.8 | 5.2<br>5.1<br>5.8 | 73.7<br>74.8<br>84.8 | 1.2<br>1.3<br>1.4 | 7.1<br>5.9<br>6.7  | 1.1<br>1.1<br>1.3 | 0.00<br>0.00<br>0.00 | 0.47<br>0.48<br>0.54 | 0.62<br>0.63<br>0.71 | 1.0 | 2800 | 2800 | 2800 | 13,240<br>13,440<br>15,230 | 83 |
| Guernsey                        | Cambridge | 1502 | 3 | 2<br>3<br>4 | 27 | 4.2 | 6.2 | 34.2<br>36.4<br>42.8 | 45.6<br>48.6<br>57.2 | 14.0<br>14.9<br>5.8 | 5.3<br>5.0<br>5.8 | 65.7<br>70.0<br>82.3 | 1.6<br>1.7<br>2.0 | 12.8<br>7.8<br>9.2 | 0.6<br>0.6<br>0.7 | 0.01<br>0.01<br>0.01 | 0.08<br>0.09<br>0.10 | 0.47<br>0.50<br>0.59 | 3.0 | 2470 | 2640 | 2740 | 11,730<br>12,500<br>14,700 | 84 |
|                                 | Monroe    | 1481 | 3 | 2<br>3<br>4 | 17 | 2.1 | 3.9 | 36.6<br>38.1<br>49.5 | 37.3<br>38.9<br>50.5 | 22.1<br>23.0<br>4.5 | 4.8<br>4.5<br>5.9 | 58.8<br>61.2<br>79.5 | 1.2<br>1.3<br>1.7 | 10.3<br>7.1<br>9.2 | 2.8<br>2.9<br>3.8 | 0.01<br>0.01<br>0.01 | 1.77<br>1.84<br>2.39 | 1.00<br>1.04<br>1.35 | 4.0 | 2750 | 2800 | 2800 | 10,720<br>11,160<br>14,490 | 84 |
|                                 | Richland  | 1506 | 3 | 2<br>3<br>4 | 21 | 1.7 | 2.9 | 37.9<br>39.1<br>48.2 | 40.8<br>42.1<br>51.8 | 18.3<br>18.8<br>5.9 | 5.0<br>4.8<br>5.9 | 63.6<br>65.6<br>80.8 | 1.5<br>1.5<br>1.9 | 8.7<br>6.3<br>7.8  | 2.9<br>3.0<br>3.6 | 0.00<br>0.00<br>0.00 | 1.48<br>1.52<br>1.88 | 1.39<br>1.43<br>1.76 | 3.5 | 2280 | 2520 | 2690 | 11,550<br>11,900<br>14,660 | 84 |



TABLE 5.—Major, minor, and trace element composition, whole-coal basis, by county

Key to symbols:

Method (column heads):

- E - by emission spectrography on ash
- NA - by neutron activation on whole coal
- WA - by wet chemistry on ash
- WW - by wet chemistry on whole coal
- XA - by X-ray fluorescence on ash
- XW - by X-ray fluorescence on whole coal

H - less than value shown  
? - bed designation tentative  
† - values for sample nos. 1466 and 1467 probably switched, based on correspondence of ash values with proximate/ultimate ash values

Analyses were performed by the U.S. Geological Survey. The analytical program of the U.S. Geological Survey is periodically revised and improved. The values reported represent the best data available at the time of manuscript preparation. Those determinations made by wet chemistry are quantitative; the remaining methods are considered semiquantitative. The following elements were looked for but not found: In, Ir, Os, Pd, Pt, Re, Rh, Ru, Te, Tm.

| Township       | Seam                        | DGS file no. | Si %<br>XA | Al %<br>XA | Ca %<br>XA | Mg %<br>WA | Na %<br>WA | K %<br>XA | Fe %<br>XA | Ti %<br>XA | Ag ppm<br>E | As ppm<br>NA | At ppm<br>E | B ppm<br>E | Ba ppm<br>E | Be ppm<br>E | Bi ppm<br>NA | Br ppm<br>NA | Cd ppm<br>WA | Ce ppm<br>NA | Cl ppm<br>XW | Co ppm<br>NA | Cr ppm<br>NA | Cs ppm<br>NA | Cu ppm<br>WA | Dy ppm<br>WA | Er ppm<br>E | Fu ppm<br>NA | F ppm<br>WV | Ga ppm<br>E | gd ppm<br>E | Ge ppm<br>E | Hf ppm<br>NA | Hg ppm<br>WV | Hpm ppm<br>E | La ppm<br>WA | Li ppm<br>WA | Lu ppm<br>NA | Mn ppm<br>WA | Mo ppm<br>E | Nb ppm<br>E | Nd ppm<br>E | Ni ppm<br>E | P ppm<br>XW | Pb ppm<br>E | Pr ppm<br>E | Rb ppm<br>NA | Sb ppm<br>NA | Sc ppm<br>NA | Se ppm<br>NA | Sm ppm<br>NA | Sn ppm<br>E | Sr ppm<br>E | Ta ppm<br>NA | Tb ppm<br>NA | Th ppm<br>NA | Ti ppm<br>E | U ppm<br>E | V ppm<br>E | W ppm<br>E | Y ppm<br>E | Yb ppm<br>NA | Zn ppm<br>WA | Zr ppm<br>E |     |     |      |     |
|----------------|-----------------------------|--------------|------------|------------|------------|------------|------------|-----------|------------|------------|-------------|--------------|-------------|------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|--------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|--------------|--------------|--------------|-------------|------------|------------|------------|------------|--------------|--------------|-------------|-----|-----|------|-----|
| BELMONT COUNTY |                             |              |            |            |            |            |            |           |            |            |             |              |             |            |             |             |              |              |              |              |              |              |              |              |              |              |             |              |             |             |             |             |              |              |              |              |              |              |              |             |             |             |             |             |             |             |              |              |              |              |              |             |             |              |              |              |             |            |            |            |            |              |              |             |     |     |      |     |
| Goshen         | Clarion (No. 4A)            | 1405         | 2.7        | 1.8        | 0.13       | 0.053      | 0.043      | 0.20      | 1.9        | 0.10       | 0.070       | 27           | 0.88L       | 55         | 130         | 2.6         | 1.9L         | 28           | 0.036        | 21           | 1,500        | 8.6          | 26           | 1.2          | 1.2          | 2.9L         | 1.4         | 0.56         | 20          | 17          | 4.2L        | 14          | 0.68         | 0.080        | 0.080        | 9.2          | 25           | 0.12         | 7.9          | 1.8         | 18          | 12          | 29          | 44L         | 6.5         | 18          | 5.0L         | 2.4          | 5.8          | 5.3          | 2.0          | 0.60L       | 49          | 0.24         | 0.38         | 0.26         | -1.3        | 1.3        | 1.1        | 29         | 1.2        | 7.8          | 1.2          | 14          | 1.7 | 1.1 | 17   |     |
|                | Lower Kittanning (No. 5)    | 1404         | 0.91       | 0.56       | 0.13       | 0.017      | 0.032      | 0.057     | 3.4        | 0.045      | 0.040       | 47           | 0.69L       | 40         | 12          | 1.9         | 0.9L         | 21           | 0.20         | 6.6          | 1,000        | 2.1          | 98           | 1.1          | 7.9          | 1.9L         | 0.40L       | 0.20         | 70          | 6.7         | 4.2L        | 14          | 0.26         | 0.13         | 0.080        | 9.4          | 25           | 0.11         | 1.6          | 4.6         | 1.8         | 12          | 28L         | 13          | 44L         | 18          | 8.8L         | 20           | 0.18         | 0.41L        | 0.16         | 0.96        | 19          | 0.80         | 0.16         | 0.96         | 0.88L       | 0.43       | 8.6        | 0.72       | 4.2        | 0.91         | 77           | 1.1         | 1.1 |     |      |     |
|                | Middle Kittanning (No. 6)   | 1403         | 1.1        | 0.68       | 0.09       | 0.023      | 0.051      | 0.10      | 0.034      | 3.1        | 0.037       | 0.10         | 3.1         | 0.65L      | 44          | 3.9         | 2.3L         | 34           | 0.059        | 2.9          | 1,400        | 6.7          | 10           | 0.87         | 8.0          | 2.0L         | 0.39        | 90           | 8.0         | 4.2L        | 14          | 0.37        | 0.14         | 0.080        | 9.4          | 25           | 0.11         | 1.6          | 4.6          | 1.8         | 12          | 28L         | 13          | 44L         | 18          | 8.8L        | 20           | 0.18         | 0.41L        | 0.16         | 0.96         | 19          | 0.80        | 0.16         | 0.96         | 0.88L        | 0.43        | 8.6        | 0.72       | 4.2        | 0.91       | 77           | 1.1          | 1.1         |     |     |      |     |
|                | Anderson Pittsburgh (No. 8) | 1402         | 1.8        | 0.91       | 0.84       | 0.065      | 0.048      | 0.13      | 0.39       | 0.051      | 0.053       | 0.39         | 1.1         | 1.6L       | 20          | 0.23        | 1.8          | 1.00         | 9.6          | 17           | 0.92         | 13           | 500          | 8.9          | 16           | 0.92         | 1.3         | 3.4L         | 0.71L       | 0.48        | 40          | 6.8         | 5.0L         | 14           | 0.40         | 0.23         | 1.1L         | 8.8          | 7.8          | 0.10        | 9.2         | 14          | 1.6         | 1.0         | 34          | 3.3         | 3.6          | 1.6          | 0.71L        | 150          | 0.13         | 0.26        | 2.1         | 1.4          | 1.2          | 1.9          | 0.61        | 1.0        | 0.98       | 6.4        | 1.6        | 1.5          | 1.1          |             |     |     |      |     |
| Kirkwood       | Meigs Creek (No. 9)         | 1400         | 3.4        | 1.2        | 0.36       | 0.22       | 0.062      | 0.27      | 2.4        | 0.079      | 0.016L      | 5.4          | 1.1         | 7.3        | 66          | 0.74        | 1.6L         | 5.9          | 0.022        | 1.3          | 350          | 29           | 22           | 1.7          | 9.2          | 3.5L         | 0.71L       | 0.35         | 140         | 5.5         | 5.1L        | 5.1         | 0.71         | 0.090        | 0.25         | 1.1L         | 7.0          | 5.1          | 0.11         | 2.4         | 2.1         | 5.7         | 1.1         | 44L         | 4.7         | 16          | 1.8          | 0.20         | 3.5          | 4.9          | 1.3          | 0.73L       | 110         | 0.21         | 0.26         | 4.0          | 1.6         | 1.7        | 2.8        | 1.3        | 7.2        | 0.90         | 7.6          | 2.2         | 2.2 | 2.2 |      |     |
|                | Quakertown (No. 2)?         | 1409         | 3.3        | 1.1        | 0.29       | 0.035      | 0.036      | 0.13      | 0.28       | 0.13       | 0.070       | 6.4          | 0.99L       | 58         | 32          | 1.9         | 1.6L         | 47           | 0.026        | 27           | 2,100        | 11           | 31           | 20           | 8.6          | 3.2L         | 0.67L       | 0.52         | 100         | 2.2         | 4.7L        | 7.2         | 0.99         | 0.25         | 1.1L         | 5.5          | 2.5          | 0.18         | 1.9          | 3.5         | 3.1         | 5.8         | 20          | 44L         | 6.9         | 15          | 2.1          | 1.9          | 6.5          | 1.0          | 2.1          | 2.0         | 4.2         | 0.39         | 0.88         | 4.4          | 1.5         | 1.4        | 2.5        | 1.3        | 7.3        | 1.92         | 1.2          | 22          | 19  | 1.1 | 1.1  |     |
|                | Clarion (No. 4A)            | 1408         | 4.9        | 2.7        | 0.28       | 0.12       | 0.069      | 0.50      | 2.6        | 0.19       | 0.087       | 16           | 1.6         | 1.6        | 69          | 4.4         | 3.2          | 2.3L         | 21           | 0.13         | 2.3          | 1,200        | 5.9          | 41           | 2.3          | 1.50L        | 1.1         | 0.48         | 80          | 3.4         | 1.3L        | 17          | 1.2          | 0.41         | 1.6          | 1.3          | 1.1          | 0.23         | 4.6          | 9.4         | 4.6         | 1.9         | 22          | 92          | 14          | 23          | 1.8          | 0.73         | 7.9          | 9.5          | 2.1          | 1.1         | 1.6         | 0.62         | 0.46         | 0.40         | 4.9         | 2.3        | 1.8        | 5.0        | 1.0        | 1.1          | 1.3          | 1.6         | 3.4 | 1.7 | 1.1  | 1.1 |
|                | Brookville (No. 4)          | 1403         | 1.1        | 0.68       | 0.09       | 0.023      | 0.051      | 0.10      | 0.034      | 3.1        | 0.037       | 0.10         | 3.1         | 0.65L      | 44          | 3.9         | 2.3L         | 34           | 0.059        | 2.9          | 1,400        | 6.7          | 10           | 0.87         | 8.0          | 2.0L         | 0.39        | 90           | 8.0         | 4.2L        | 14          | 0.37        | 0.14         | 0.080        | 9.4          | 25           | 0.11         | 1.6          | 4.6          | 1.8         | 12          | 28L         | 13          | 44L         | 18          | 8.8L        | 20           | 0.18         | 0.41L        | 0.16         | 0.96         | 19          | 0.80        | 0.16         | 0.96         | 0.88L        | 0.43        | 8.6        | 0.72       | 4.2        | 0.91       | 77           | 1.1          | 1.1         |     |     |      |     |
| Richland       | Lower Kittanning (No. 5)    | 1430-1       | 20         | 5.4        | 0.12       | 0.051      | 0.079      | 0.62      | 1.1        | 0.70       | 0.21        | 67           | 3.8         | 1.8        | 85          | 120         | 4.9          | 5.7L         | 13           | 0.057        | 67           | 380          | 4.1          | 59           | 18           | 26           | 1.2         | 1.6          | 1.3         | 90          | 23          | 18          | 1.4          | 0.57         | 0.42         | 3.8          | 38           | 40           | 0.47         | 14          | 2.5         | 25          | 4.5         | 16          | 61          | 23          | 57           | 1.4          | 50           | 0.60         | 10           | 9.3         | 5.6         | 6.2          | 120          | 1.6          | 1.2         | 9.4        | 5.7        | 1.4        | 3.9        | 7.9          | 1.8          | 23          | 4.3 | 6.8 | 4.40 |     |
|                | Upper Freeport (No. 7)      | 1437         | 2.8        | 0.35       | 0.27       | 0.011      | 0.034      | 0.015     | 4.3        | 0.017      | 0.068       | 15           | 0.94L       | 43         | 6.2         | 3.3         | 1.4L         | 19           | 0.099        | 5.0          | 2,000        | 2.1          | 5.8          | 0.05         | 9.2          | 3.0L         | 0.63L       | 0.20         | 60          | 6.5         | 4.4L        | 15          | 0.10L        | 0.094L       | 0.20         | 1.4          | 0.14         | 18           | 6.9          | 2.2         | 4.4L        | 29          | 61          | 2.5         | 14          | 20          | 0.65         | 1.3          | 1.0          | 0.70         | 1.9          | 0.070L      | 0.19        | 0.54         | 1.4          | 0.39         | 7.6         | 0.62       | 1.0        | 1.2        | 2.9        | 1.1          | 1.1          |             |     |     |      |     |
|                | Middle Kittanning (No. 6)   | 1407         | 1.4        | 0.89       | 0.090      | 0.040      | 0.019      | 0.114     | 0.060      | 0.054      | 0.026       | 7.6          | 0.42L       | 17         | 0.93        | 1.7         | 0.9L         | 21           | 0.021        | 13           | 1,000        | 2.9          | 15           | 0.39         | 8.1          | 1.4L         | 0.29L       | 0.28         | 120         | 0.93L       | 2.0L        | 24          | 0.71         | 0.23         | 0.42L        | 7.1          | 17           | 0.15         | 4.5          | 0.55        | 1.2         | 40          | 93          | 44L         | 7.4         | 6.2L        | 20           | 1.2          | 0.23         | 2.9          | 2.9          | 1.2         | 0.29L       | 12           | 0.22         | 0.26         | 0.62L       | 5.9        | 1.3        | 0.55       | 2.4        | 0.94         | 8.7          | 6.8         |     |     |      |     |
|                | Anderson                    | 1398         | 4.1        | 2.1        | 0.13       | 0.038      | 0.047      | 0.28      | 0.13       | 0.057      | 0.47        | 7.8          | 1.3         | 7.1        | 71          | 45          | 1.4          | 1.9L         |              |              |              |              |              |              |              |              |             |              |             |             |             |             |              |              |              |              |              |              |              |             |             |             |             |             |             |             |              |              |              |              |              |             |             |              |              |              |             |            |            |            |            |              |              |             |     |     |      |     |



TABLE 6.—Major, minor, and trace element composition, whole coal basis, by bed

Key to symbols:  
Method (column heads):  
E — by emission spectrography on ash  
NA — by neutron activation on whole coal  
WA — by wet chemistry on ash  
WW — by wet chemistry on whole coal  
XA — by X-ray fluorescence on ash  
XW — by X-ray fluorescence on whole coal

H — not determined due to interference  
L — less than value shown  
? — bed designation tentative

— values for sample nos. 1466 and 1467 probably shifted, based on correspondence of ash values with proximate ultimate ash values

Analyses were performed by the U.S. Geological Survey. The analytical program of the U.S. Geological Survey is periodically revised and improved. The values reported represent the best data available at the time of manuscript preparation. Those determinations made by wet chemistry are quantitative; the remaining data are considered semiquantitative. The following elements were looked for but not found: In, Ir, Os, Pd, Pt, Re, Rh, Ru, Sb, Te, Tm.

| County                  | Township   | DGS file no. | Si   | %    | Al    | %     | Ca    | %     | Mg    | %     | Na    | %     | K     | %     | Fe    | %     | Ti    | %     | Ag    | %     | As    | %     | B     | %     | Br    | %     | Cd    | %     | Ce    | %     | Cl    | %     | Co    | %     | Cr    | %     | Cu    | %     | Dy    | %     | Er    | %     | Eu    | %     | F     | %     | Ga    | %     | Gd    | %     | Ge    | %     | Hf    | %     | Hg    | %     | Ho    | %     | La    | %     | Li    | %    | Lu  | %   | Mn  | %  | Mo | % | Nb | % | Nd | % | Ni | % | P | % | Pb | % | Pr | % | Rb | % | Sb | % | Sc | % | Se | % | Sm | % | Sr | % | Ta | % | Tb | % | Th | % | Tl | % | U | % | V | % | W | % | Y | % | Yb | % | Zn | % | Zr | % |
|-------------------------|------------|--------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-----|-----|-----|----|----|---|----|---|----|---|----|---|---|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|---|---|---|---|---|---|---|---|----|---|----|---|----|---|
| SHARON (NO. 1) COAL     |            |              | 1005 | 2.5  | 2.1   | 0.061 | 0.044 | 0.057 | 0.17  | 1.2   | 0.083 | 0.22  | 56    | 0.86L | 44    | 33    | 4.7   | 1.3L  | 14    | 0.13  | 29    | 940   | 16    | 28    | 1.1   | 17    | 2.8L  | 0.58L | 0.55  | 260   | 14    | 6.2   | 25    | 0.60  | 0.060 | 1.4   | 18    | 20    | 0.16  | 32    | 3.6   | 2.7   | 25    | 66    | 44    | 19    | 12    | 14    | 2.9   | 6.3   | 5.8   | 2.3   | 0.58L | 44    | 0.17  | 0.45  | 3.0   | 1.3 L | 1.3   | 33    | 1.7   | 1.2  | 32  | 18  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
| QUAKERTOWN (NO. 2) COAL |            |              | 1409 | 3.3  | 1.1   | 0.29  | 0.035 | 0.036 | 0.13  | 2.8   | 0.13  | 0.070 | 64    | 0.99L | 58    | 32    | 1.9   | 1.5L  | 47    | 0.026 | 27    | 2,100 | 11    | 31    | 20    | 8.6   | 3.2L  | 0.67L | 0.52  | 100   | 2.2 L | 4.7L  | 7.2   | 0.99  | 0.25  | 0.99L | 15    | 2.5   | 0.18  | 19    | 3.5   | 3.1   | 5.8   | 20    | 44L   | 6.9   | 15 L  | 21    | 1.9   | 6.5   | 10    | 2.1   | 2.0   | H     | 42    | 0.39  | 0.38  | 4.4   | 1.5 L | 1.4   | 25    | 1.3  | 1.5 | 7.2 | 1.2 | 22 | 19 |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
| Belmont                 | Kirkwood   | 1431         | 2.1  | 1.3  | 0.080 | 0.069 | 0.023 | 0.051 | 2.0   | 0.20  | 0.12  | 81    | 0.75L | 45    | 44    | 3.6   | 1.1L  | 46    | 0.035 | 64    | 2,200 | 6.0   | 35    | 0.23  | 30    | 1.4   | 0.63  | 0.62  | 1.4   | 10    | 6.3   | 6.2   | 1.4   | 0.42  | 0.75L | 39    | 11    | 0.14  | 2.6   | H     | 11    | 34    | 210   | 23    | 19    | 50 L  | 1.2   | 8.3   | 12    | 3.8   | H     | 300   | 0.57  | 0.58  | 7.3   | 1.1   | 0.78  | 15    | 1.5   | 1.5   | 1.2   | 74   |     |     |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | Guernsey   | 1470         | 3.6  | 1.8  | 0.070 | 0.067 | 0.024 | 0.028 | 1.0   | 0.16  | 0.072 | 12    | 0.97L | 61    | 23    | 4.1   | 1.0L  | 67    | 0.037 | 61    | 2,200 | 8.6   | 20    | 0.14  | 16    | 2.1L  | 0.44L | 0.23  | 260   | 70    | 3.0L  | 6.2   | 0.47  | 0.080 | 0.65L | 5.8   | 9.1   | 0.15  | 4.3   | 4.6   | 1.2   | 6.7   | 33    | 44L   | 25    | 9.5L  | 29    | 1.3   | 3.9   | 4.5   | 1.2   | 0.44L | 33    | 0.16  | 0.17  | 2.0   | 0.95L | 2.9   | 0.56  | 8.1   | 1.0   | 90   | 10  |     |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | Spencer    | 1500         | 1.9  | 1.4  | 0.080 | 0.041 | 0.062 | 0.18  | 1.3   | 0.062 | 0.086 | 41    | 0.65L | 51    | 23    | 3.1   | 1.0L  | 67    | 0.017 | 8.8   | 3,300 | 18    | 21    | 0.92  | 14    | 2.1L  | 0.44L | 0.23  | 260   | 7.0   | 4.6L  | 3.0L  | 6.2   | 0.47  | 0.080 | 0.65L | 5.8   | 9.1   | 0.15  | 4.3   | 4.6   | 1.2   | 6.7   | 33    | 44L   | 25    | 9.5L  | 29    | 1.3   | 3.9   | 4.5   | 1.2   | 0.44L | 33    | 0.16  | 0.17  | 2.0   | 0.95L | 2.9   | 0.56  | 8.1   | 1.0  | 90  | 10  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
| BEDFORD COAL            |            |              | 1454 | 12   | 6.2   | 0.19  | 0.29  | 0.20  | 1.0   | 1.5   | 0.66  | 0.17  | 4.6   | 3.1 L | 100   | 130   | 5.9   | 4.5L  | 20    | 0.045 | 90    | 760   | 34    | 90    | 3.8   | 77    | 10 L  | 2.1 L | 1.2   | 160   | 31    | 15 L  | 10    | 4.2   | 0.44  | 3.1 L | 41    | 50    | 0.39  | 23    | 3.4   | 20    | 50    | 29    | 61    | 30    | 45 L  | 48    | 0.95  | 19    | 28    | 5.4   | 5.4   | 100   | 1.7   | 1.0   | 19    | 4.5 L | 12    | 95    | 2.0   | 24   | 3.0 | 13  | 120 |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
| Belmont                 | Goshen     | 1414         | 5.0  | 3.2  | 0.10  | 0.087 | 0.080 | 0.40  | 3.0   | 0.36  | 0.12  | 61    | 1.6 L | 47    | 52    | 2.4   | 2.4L  | 24    | 0.038 | 35    | 840   | 4.2   | 49    | 15    | 20    | 5.2L  | 1.1 L | 0.58  | 90    | 16    | 7.5L  | 6.3   | 1.9   | 0.37  | 1.6 L | 19    | 20    | 0.23  | 10    | 3.3   | 7.1   | 20    | 23    | 44L   | 15    | 24 L  | 18    | 1.2   | 8.6   | 11    | 2.3   | 3.5   | 49    | 0.76  | 0.45  | 8.0   | 2.4 L | 3.2   | 45    | 1.1   | 9.6   | 1.7  | 7.5 | 35  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | York       | 1476         | 3.1  | 1.8  | 0.53  | 0.050 | 0.049 | 0.20  | 0.90  | 0.12  | 0.096 | 74    | 0.91L | 72    | 260   | 33    | 1.4L  | 39    | 0.072 | 15    | 2,100 | 3.5   | 31    | 1.1   | 17    | 5.3   | 0.64L | 0.43  | 90    | 18    | 4.4L  | 15    | 0.82  | 0.20  | 0.95L | 7.2   | 15    | 0.05L | 24    | 4.2   | 2.4   | 6.3   | 14    | 66    | 7.4   | 14 L  | 13    | 0.22  | 5.8   | 5.2   | 1.5   | 1.5   | 86    | 0.28  | 0.27  | 3.4   | 1.4 L | 1.1   | 38    | 1.1   | 7.2   | 1.0  | 17  | 17  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | Guernsey   | 1461         | 3.3  | 2.4  | 0.32  | 0.13  | 0.10  | 0.43  | 2.1   | 0.16  | 0.11  | 13    | 1.3 L | 73    | 71    | 3.9   | 2.0L  | 27    | 1.1   | 24    | 1,500 | 5.0   | 29    | 2.3   | 24    | 4.3L  | 0.90L | 0.49  | 80    | 25    | 1.3L  | 1.8   | 0.61  | 0.26  | 1.1   | 10    | 27    | 0.18  | 6.1   | 5.1   | 5.5   | 14    | 37    | 44L   | 15    | 20 L  | 26    | 2.0   | 8.2   | 5.1   | 1.9   | 0.90L | 57    | 0.44  | 0.46  | 4.5   | 2.0 L | 6.8   | 41    | 1.1   | 1.6   | 240  | 37  |     |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
| Stark                   | Washington | 1473         | 4.6  | 2.6  | 0.17  | 0.092 | 0.060 | 0.35  | 0.72  | 0.18  | 0.11  | 9.0   | 1.2 L | 92    | 94    | 4.9   | 1.8L  | 26    | 0.24  | 21    | 1,300 | 5.4   | 40    | 2.1   | 27    | 4.0L  | 0.83L | 0.66  | 30    | 24    | 5.8L  | 3.1   | 1.2   | 0.30  | 1.2 L | 8.1   | 27    | 0.17  | 1.6   | 6.5   | 4.9   | 20    | 52    | 44L   | 15    | 18 L  | 18    | 1.3   | 11    | 6.4   | 2.2   | 0.62  | 0.94  | 14    | 1.4   | 8.1   | 33    |       |       |       |       |      |     |     |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | Wills      | 1479         | 4.2  | 2.6  | 0.25  | 0.087 | 0.062 | 0.35  | 1.0   | 0.16  | 0.080 | 5.0   | 1.2 L | 74    | 110   | 2.8   | 1.8L  | 35    | 0.092 | 19    | 1,800 | 3.9   | 36    | 1.7   | 11    | 3.9L  | 0.81L | 0.44  | 70    | 13    | 5.7L  | 6.9   | 1.0   | 0.19  | 1.2 L | 8.3   | 27    | 0.08  | 23    | 12    | 4.2   | 1.5   | 21    | 44    | 8.5   | 18 L  | 23    | 0.40  | 6.1   | 5.5   | 1.7   | 1.6   | 65    | 0.40  | 0.35  | 4.1   | 1.8 L | 9.7   | 46    | 0.98  | 9.0   | 0.99 | 18  | 28  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | Pike       | 1418         | 2.2  | 1.5  | 0.23  | 0.076 | 0.041 | 0.17  | 0.72  | 0.053 | 0.085 | 37    | 0.69L | 91    | 25    | 2.8   | 1.0L  | 29    | 0.20  | 9.3   | 1,600 | 8.3   | 20    | 0.49  | 8.0   | 2.2L  | 0.46L | 0.31  | 50    | 15    | 3.2L  | 15    | 0.38  | 0.21  | 0.69L | 3.2   | 5.7   | 0.07  | 27    | 8.0   | 1.8   | 9.9   | 45    | 44L   | 6.6   | 10 L  | 7.0   | 0.33  | 4.4   | 5.0   | 1.3   | 1.7   | 42    | 0.090 | 0.25  | 1.9   | 1.0 L | 10    | 31    | 1.1   | 8.3   | 0.88 | 32  | 15  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
| Sandy                   | York       | 1434         | 1.1  | 0.72 | 0.15  | 0.028 | 0.027 | 0.056 | 3.0   | 0.037 | 0.11  | 97    | 0.63L | 64    | 26    | 2.4   | 0.9L  | 20    | 0.085 | 5.8   | 840   | 4.1   | 16    | 0.30  | 4.9   | 2.0L  | 0.42L | 0.20  | 20    | H     | 2.9L  | 19    | 0.35  | 0.33L | 0.63L | 1.9   | 4.0   | 0.05  | 25    | H     | 1.8   | 7.4   | 21    | 44L   | 16    | 9.2L  | 9.0L  | 0.61  | 3.3   | 4.4   | 0.84  | H     | 36    | 0.980 | 0.13  | 1.5   | 1.1   | 4.1   | 17    | 0.99  | 4.9   | 0.48 | 27  | 15  |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |
|                         | Monroe     | 1430         | 3.1  | 1.6  | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 |      |     |     |     |    |    |   |    |   |    |   |    |   |   |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |   |   |    |   |    |   |    |   |



TABLE 7.—Major and minor oxide and trace element composition of the laboratory ash, by county

Key to symbols:  
Method (column heads):  
E - by emission spectrography on ash  
NA - by neutron activation on whole coal  
WA - by wet chemistry on ash  
XA - by X-ray fluorescence on ash  
XW - by X-ray fluorescence on whole coal  
H - not determined due to interference  
L - less than value shown  
? - had designations tentative  
- values for sample nos. 1466 and 1467 probably switched, based on correspondence of ash values with proximate/ultimate ash values

Analyses were performed by the U.S. Geological Survey. The coals were ashed at 525°C for major, minor, and trace element analysis. These values may not agree exactly with ash values in standard proximate analysis. The analytical program of the U.S. Geological Survey is periodically revised and improved. The values reported represent the best data available at the time of manuscript preparation. The values for trace elements are qualitative, the remaining methods are quantitative. Values are within one bracket at 68% confidence level and two brackets at 95% confidence level. The bracket is logarithmically defined as +50%, -33% of methods reported\* (U.S. Geological Survey, written commun., 1979). Ash figure is percentage of total coal; SO<sub>2</sub> figure only shows sulfur retained by the sample on ashing. Values for S in the whole coal should be taken from the proximate/ultimate ash values (tables 3 and 4).

The following elements were looked for by emission spectrographic analysis of the ash and were not found: In, Ir, Os, Pd, Pt, Re, Rh, Ru, Te, Tm.

| Township               | Seam                      | DGS file no.              | Ash % XA | SiO <sub>2</sub> % XA | Al <sub>2</sub> O <sub>3</sub> % XA | CaO % XA | MgO % WA | Na <sub>2</sub> O % WA | K <sub>2</sub> O % XA | Fe <sub>2</sub> O <sub>3</sub> % XA | TiO <sub>2</sub> % XA | P <sub>2</sub> O <sub>5</sub> % XW | SO <sub>2</sub> % XA | Ag ppm E | Au ppm E | B ppm E | Ba ppm E | Be ppm E | Bi ppm E | Cd ppm WA | Ce ppm NA | Co ppm NA | Cr ppm NA | Cs ppm NA | Cu ppm WA | Dy ppm E | Er ppm E | Eu ppm NA | Ga ppm E | Gd ppm E | Ge ppm E | Hf ppm NA | Ho ppm E | La ppm NA | Li ppm WA | Lu ppm NA | Mn ppm WA | Mo ppm E | Nb ppm E | Nd ppm E | Ni ppm E | Pb ppm WA | Pr ppm E | Rb ppm NA | Sc ppm NA | Sm ppm NA | Sr ppm E | Ta ppm NA | Tb ppm NA | Th ppm NA | Ti ppm E | U ppm NA | V ppm E | W ppm NA | Y ppm E | Yb ppm NA | Zn ppm WA | Zr ppm E |     |     |
|------------------------|---------------------------|---------------------------|----------|-----------------------|-------------------------------------|----------|----------|------------------------|-----------------------|-------------------------------------|-----------------------|------------------------------------|----------------------|----------|----------|---------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|----------|----------|---------|----------|---------|-----------|-----------|----------|-----|-----|
| BELMONT COUNTY         | Clarion (No. 4A)          | 1405                      | 13.0     | 45                    | 26                                  | 1.4      | 0.68     | 0.45                   | 1.9                   | 21                                  | 0.85                  | 0.077L                             | 1.7                  | 0.54     | 6.8L     | 420     | 970      | 20       | 10L      | 0.28      | 160       | 66        | 200       | 9.4       | 92        | 22L      | 11       | 4.3       | 130      | 32L      | 110      | 5.2       | 6.8L     | 72        | 190       | 0.9       | 61        | 14       | 14       | 89       | 220      | 50        | 140      | 38L       | 45        | 15        | 4.6L     | 380       | 1.9       | 2.9       | 22       | 10L      | 8.4     | 220      | 8.9     | 60        | 3.9       | 110      | 130 |     |
|                        | Lower Kittanning (No. 5)  | 1404                      | 8.8      | 22                    | 12                                  | 2.1      | 0.32     | 0.49                   | 0.78                  | 55                                  | 1.83                  | 0.11 L                             | 2.6                  | 0.46     | 6.8L     | 450     | 140      | 22       | 10L      | 2.3       | 75        | 24        | 110       | 2.4       | 90        | 22L      | 4.1      | 67        | 130      | 160      | 30       | 6.8L      | 37       | 44        | 1.2       | 180       | 52        | 12       | 32L      | 150      | 150      | 150       | 29       | 9.0       | H         | 220       | 0.9      | 1.8       | 11        | 10L       | 4.9      | 98       | 8.2     | 48       | 10      | 880       | 120       |          |     |     |
|                        | Middle Kittanning (No. 6) | 1403                      | 8.9      | 34                    | 21                                  | 2.9      | 0.71     | 0.62                   | 1.7                   | 32                                  | 1.1                   | 0.11 L                             | 2.2                  | 0.32     | 6.8L     | 460     | 610      | 19       | 10L      | 0.50      | 120       | 30        | 170       | 9.8       | 95        | 22L      | 18       | 4.3       | 65       | 32L      | 88       | 46        | 6.8L     | 56        | 120       | 12        | 210       | 26       | 12       | 50       | 100      | 40        | 100L     | 130       | 37        | 14        | 4.6L     | 270       | 1.6       | 3.4       | 20       | 10L      | 11      | 180      | 6.5     | 73        | 12        | 140      | 130 |     |
|                        | Anderson                  | 1402                      | 15.5     | 25                    | 11                                  | 7.6      | 0.70     | 0.42                   | 1.0                   | 36                                  | 0.55                  | 1.0                                | 7.9                  | 0.34     | 6.8L     | 220     | 11,000   | 20       | 10L      | 1.5       | 110       | 62        | 110       | 5.9       | 84        | 22L      | 4.6L     | 3.1       | 44       | 32L      | 91       | 2.6       | 6.8L     | 57        | 50        | 0.6       | 600       | 88       | 12       | 32L      | 150      | 90        | 100L     | 21        | 10L       | 4.6L      | 940      | 0.8       | 1.7       | 13        | 92       | 8.0      | 120     | 3.9      | 66      | 6.3       | 410       | 150      |     |     |
|                        | Pittsburgh (No. 8)        | 1401                      | 11.4     | 37                    | 17                                  | 1.6      | 0.66     | 0.40                   | 1.8                   | 37                                  | 0.85                  | 0.18                               | 2.1                  | 0.50     | 6.8L     | 250     | 220      | 10       | 10L      | 0.76      | 110       | 78        | 140       | 8.4       | 40        | 22L      | 3.2      | 3.9       | 42       | 32L      | 32       | 3.9       | 6.8L     | 40        | 47        | 0.7       | 150       | 28       | 15       | 32L      | 130      | 20        | 100L     | 110       | 26        | 11        | H        | 310       | 1.3       | 2.2       | 15       | 10L      | 9.3     | 130      | 3.7     | 53        | 7.4       | 160      | 130 |     |
| Kirkwood               | Meigs Creek (No. 9)       | 1400                      | 15.8     | 46                    | 14                                  | 3.2      | 2.3      | 0.53                   | 2.1                   | 32                                  | 0.84                  | 0.063L                             | 4.0                  | 0.10L    | 6.8L     | 460     | 420      | 4.7      | 10L      | 0.14      | 82        | 18        | 140       | 11        | 58        | 22L      | 4.6L     | 2.2       | 35       | 32L      | 32       | 4.5       | 6.8L     | 44        | 32        | 0.7       | 150       | 13       | 17       | 32L      | 67       | 30        | 100L     | 110       | 22        | 8.5       | 4.6L     | 720       | 1.3       | 1.6       | 25       | 10L      | 23      | 180      | 11      | 46        | 5.7       | 48       | 140 |     |
|                        | Quakertown (No. 2)?       | 1409                      | 14.6     | 48                    | 14                                  | 2.8      | 0.40     | 0.34                   | 1.1                   | 28                                  | 1.4                   | 0.068L                             | 1.4                  | 0.48     | 6.8L     | 400     | 220      | 13       | 10L      | 0.18      | 180       | 74        | 210       | 14        | 59        | 22L      | 4.6L     | 3.6       | 15       | L        | 32L      | 49        | 6.8      | 6.8L      | 100       | 17        | 1.2       | 130      | 24       | 21       | 40       | 140       | 47       | 100L      | 140       | 45        | 15       | 1.4       | 1,800     | 5.2       | 5.3      | 66       | 10L     | 19       | 350     | 14        | 140       | 14       | 110 | 670 |
|                        | Clarion (No. 4A)          | 1431                      | 11.0     | 42                    | 22                                  | 1.0      | 0.13     | 0.28                   | 0.55                  | 26                                  | 3.1                   | 0.44                               | 1.4                  | 1.1      | 6.8L     | 410     | 400      | 33       | 10L      | 0.32      | 580       | 55        | 320       | 2.1       | 270       | 38       | 25       | 9.1       | H        | 57       | 56       | 73        | 6.8L     | 350       | 100       | 1.3       | 24        | H        | 100      | 310      | 260      | 210       | 170      | 450L      | 76        | 34        | H        | 1,800     | 5.2       | 5.3       | 66       | 10L      | 19      | 350      | 14      | 140       | 14        | 110      | 670 |     |
|                        |                           | 1424                      | 22.9     | 46                    | 16                                  | 1.4      | 0.82     | 0.40                   | 2.6                   | 16                                  | 1.4                   | 0.092                              | 1.5                  | 0.38     | 6.8L     | 300     | 190      | 14       | 10L      | 0.58      | 99        | 26        | 180       | 9.8       | 58        | 22L      | 4.6L     | 2.1       | 15       | L        | 32L      | 74        | 5.4      | 6.8L      | 56        | 46        | 10        | 200      | 41       | 20       | 83       | 98        | 60       | 100L      | 150       | 35        | 9.1      | 4.6L      | 270       | 2.0       | 1.7      | 21       | 10L     | 36       | 220     | 4.4       | 49        | 5.7      | 70  | 150 |
|                        |                           | 1430                      | 17.6     | 50                    | 30                                  | 1.2      | 0.48     | 0.43                   | 1.4                   | 8.6                                 | 1.8                   | 0.057L                             | 1.3                  | 0.79     | 6.8L     | 490     | 950      | 17       | 10L      | 0.10      | 190       | 23        | 220       | 4.4       | 120       | 22L      | 4.6L     | 3.6       | 77       | 32L      | 34       | 5.5       | 6.8L     | 93        | 150       | 0.6       | 110       | 15       | 37       | 170      | 97       | 51        | 100L     | 170L      | 39        | 15        | 11       | 420       | 2.2       | 2.4       | 28       | 10L      | 15      | 220      | 6.0     | 53        | 6.4       | 53       | 210 |     |
|                        |                           | 1430-1                    | 56.6     | 74                    | 18                                  | 0.29     | 0.15     | 0.19                   | 1.3                   | 2.9                                 | 2.1                   | 0.025                              | 0.38                 | 0.37     | 6.8L     | 150     | 220      | 8.6      | 10L      | 0.10      | 120       | 7.3       | 100       | 3.1       | 46        | 22L      | 4.6L     | 2.3       | 41       | 32L      | 10       | 13        | 6.8L     | 66        | 70        | 0.8       | 24        | 4.5      | 45       | 80       | 28       | 40        | 100L     | 180L      | 18        | 9.9       | 11       | 420       | 2.9       | 2.2       | 17       | 10L      | 6.0     | 140      | 3.2     | 40        | 7.6       | 12       | 770 |     |
|                        |                           | 1397                      | 13.8     | 43                    | 4.9                                 | 2.8      | 0.13     | 0.34                   | 0.13                  | 44                                  | 0.20                  | 0.15                               | 2.1                  | 0.49     | 6.8L     | 310     | 45       | 24       | 10L      | 0.72      | 36        | 15        | 42        | 0.36      | 67        | 22L      | 4.6L     | 1.4       | 47       | 32L      | 110      | 1.3       | 0.72L    | 6.8L      | 44        | 10        | 10        | 130      | 50       | 16       | 32L      | 210       | 40       | 100L      | 140L      | 9.1       | 5.1      | H         | 140       | 0.5L      | 1.4      | 3.9      | 10L     | 2.8      | 55      | 4.5       | 75        | 8.4      | 210 | 80  |
|                        |                           | 1407                      | 6.2      | 49                    | 27                                  | 0.69     | 1.1      | 0.42                   | 2.8                   | 14                                  | 1.5                   | 0.16 L                             | 1.1                  | 0.42     | 6.8L     | 280     | 160      | 7.0      | 10L      | 0.34      | 210       | 46        | 240       | 6.3       | 130       | 22L      | 4.6L     | 4.5       | 5.1      | 32L      | 38       | 11        | 6.8L     | 110       | 280       | 2.4       | 73        | 8.8      | 20       | 65       | 150      | 120       | 20       | 46L       | 200       | 4.4       | 3.5      | 42        | 10L       | 9.5       | 210      | 8.9      | 38      | 15       | 140     | 110       |           |          |     |     |
|                        |                           | 1429                      | 32.1     | 88                    | 3.3                                 | 0.70     | 0.05     | 0.09                   | 0.24                  | 9.0                                 | 0.23                  | 0.031L                             | 0.68                 | 0.25     | 6.8L     | 190     | 130      | 7.0      | 10L      | 0.10      | 17        | 6.7       | 26        | 0.69      | 48        | 22L      | 4.6L     | 0.78      | 5.1      | 32L      | 33       | 0.78      | 6.8L     | 9.0       | 12        | 0.2       | 29        | 3.8      | 14       | 32L      | 56       | 22        | 100L     | 93L       | 6.6       | 2.4       | 4.6L     | 40        | 0.3       | 0.97      | 3.6      | 10L      | 3.5     | 39       | 1.1     | 31        | 2.3       | 38       | 96  |     |
|                        |                           | Middle Kittanning (No. 6) | 1398     | 18.7                  | 47                                  | 21       | 0.99     | 1.1                    | 0.61                  | 3.0                                 | 21                    | 1.2                                | 0.053L               | 1.8      | 0.25     | 6.8L    | 380      | 240      | 7.6      | 10L       | 0.20      | 88        | 14        | 120       | 13        | 73       | 22L      | 4.6L      | 2.0      | 44       | 32L      | 16        | 4.2      | 6.8L      | 49        | 120       | 0.6       | 78       | 12       | 10       | 32L      | 65        | 30       | 100L      | 140       | 23        | 7.5      | 4.6L      | 250       | 1.6       | 1.3      | 15       | 10L     | 26       | 120     | 3.6       | 31        | 5.3      | 63  | 89  |
| Upper Freeport (No. 7) |                           | 1406                      | 21.9     | 41                    | 15                                  | 9.0      | 0.42     | 0.27                   | 0.84                  | 21                                  | 0.90                  | 0.046L                             | 7.0                  | 0.49     | 6.8L     | 300     | 140      | 29       | 10L      | 0.54      | 110       | 25        | 130       | 11        | 61        | 26       | 4.6L     | 2.1       | 15       | L        | 32L      | 140       | 4.8      | 6.8L      | 56        | 80        | 1.2       | 79       | 77       | 17       | 56       | 120       | 47       | 100L      | 120       | 27        | 8.3>     |           |           |           |          |          |         |          |         |           |           |          |     |     |



TABLE 8.—Major and minor oxide and trace element composition of the laboratory ash, by bed

Key to symbols:  
Method (column heads):E - by emission spectrography on ash  
NA - by neutron activation on whole coal  
WA - by wet chemistry on ash  
XA - by X-ray fluorescence on ash  
XW - by X-ray fluorescence on whole coal  
H - not determined due to interference  
L - less than value shown  
? - bed designation tentative  
- values for sample nos. 1466 and 1467 probably switched, based on correspondence of ash values with proximate/ultimate ash values

Analyses were performed by the U.S. Geological Survey. The coals were ashed at 525°C for major, minor, and trace element analysis. These values may not agree exactly with the values in standard proximate analysis. The analytical program of the U.S. Geological Survey is periodically revised and improved. The values reported represent the best data available at the time of manuscript preparation. Those determinations made by wet chemistry are quantitative; the remaining methods are considered semiquantitative. The precision and accuracy of the computer spectrographic values (E) are within one bracket at 98% confidence level and two brackets at 95% confidence level. The bracket is logarithmically defined as +56%, -33% of value reported\* (U.S. Geological Survey, written commun., 1979). Ash figure is percentage of total coal; SO<sub>2</sub> figure only shows sulfur retained by the sample on ashing. Values for S in the whole coal should be taken from the proximate-ultimate analyses (tables 3 and 4).

The following elements were looked for by emission spectrographic analysis of the ash and were not found: In, Ir, Os, Pd, Pt, Re, Rh, Ru, Te, Tm.

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TABLE 8.

| County                   | Township    | DGS file no. | Ash % XA | SiO <sub>2</sub> % XA | Al <sub>2</sub> O <sub>3</sub> % XA | CaO % WA | MgO % WA | Na <sub>2</sub> O % WA | K <sub>2</sub> O % XA | Fe <sub>2</sub> O <sub>3</sub> % XA | TiO <sub>2</sub> % XA | P <sub>2</sub> O <sub>5</sub> % XW | SO <sub>2</sub> % XA | Ag ppm E | Au ppm E | B ppm E | Ba ppm E | Be ppm E | Bi ppm E | Cd ppm WA | Ce ppm NA | Co ppm NA | Cr ppm NA | Cs ppm NA | Cu ppm WA | Dy ppm E | Er ppm E | Eu ppm NA | Ga ppm E | Gd ppm E | Ge ppm E | Hf ppm NA | Ho ppm E | La ppm NA | Li ppm WA | Mn ppm WA | Mo ppm E | Nb ppm E | Nd ppm E | Ni ppm E | Pb ppm WA | Pr ppm E | Rb ppm NA | Sc ppm NA | Sm ppm NA | Sr ppm E | Sr ppm E | Ta ppm NA | Tb ppm NA | Ti ppm NA | Ti ppm E | U ppm NA | V ppm E | W ppm NA | Y ppm E | Yb ppm NA | Zn ppm WA | Zr ppm E |     |     |     |     |     |     |
|--------------------------|-------------|--------------|----------|-----------------------|-------------------------------------|----------|----------|------------------------|-----------------------|-------------------------------------|-----------------------|------------------------------------|----------------------|----------|----------|---------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|----------|----------|---------|----------|---------|-----------|-----------|----------|-----|-----|-----|-----|-----|-----|
| SHARON (NO. 1) COAL      |             |              |          |                       |                                     | 1005     | 12.7     | 42                     | 32                    | 0.67                                | 0.58                  | 0.61                               | 1.6                  | 13       | 1.1      | 0.079   | 1.5      | 1.7      | 6.8L     | 350       | 260       | 37        | 10L       | 1.0       | 230       | 130      | 220      | 8.7       | 130      | 22L      | 4.6L     | 4.3       | 110      | 49        | 200       | 4.7       | 11       | 140      | 160      | 1.3      | 250       | 28       | 21        | 200       | 520       | 150      | 95       | 110       | 50        | 18        | 4.6L     | 350      | 1.3     | 3.5      | 24      | 10L       | 9.8       | 260      | 13  | 98  | 9.4 | 250 | 140 |     |
| QUAKERTOWN (NO. 2)* COAL |             |              |          |                       |                                     | 1409     | 14.6     | 48                     | 14                    | 2.8                                 | 0.40                  | 0.34                               | 1.1                  | 28       | 1.4      | 0.068L  | 1.4      | 1.4      | 0.48     | 6.8L      | 400       | 220       | 13        | 10L       | 0.18      | 180      | 74       | 210       | 14       | 59       | 22L      | 4.6L      | 3.6      | 15        | 32L       | 49        | 6.8      | 6.8L     | 100      | 17       | 1.2       | 130      | 24        | 21        | 40        | 140      | 47       | 100L      | 140       | 45        | 15       | 14       | 290     | 2.7      | 2.6     | 30        | 10L       | 9.5      | 170 | 9.1 | 49  | 7.9 | 150 | 130 |
| Belmont                  | Kirkwood    | 1431         | 11.0     | 42                    | 22                                  | 1.0      | 0.13     | 0.28                   | 0.55                  | 26                                  | 3.1                   | 0.44                               | 1.1                  | 0.68L    | 4.1      | 1.1     | 6.8L     | 410      | 400      | 33        | 10L       | 0.32      | 580       | 55        | 320       | 21       | 270      | 38        | 25       | 9.1      | 4        | H         | 57       | 56        | 13        | 6.8L      | 350      | 100      | 1.3      | 24       | H         | 100      | 310       | 260       | 210       | 66       | 10L      | 19        | 350       | 14        | 140      | 11       | 620     | 670      |         |           |           |          |     |     |     |     |     |     |
|                          | Spencer     | 1470         | 14.3     | 54                    | 24                                  | 0.69     | 0.78     | 0.51                   | 0.28                  | 10                                  | 1.8                   | 0.070L                             | 0.85                 | 0.50     | 0.68L    | 430     | 420      | 33       | 10L      | 0.40      | 110       | 60        | 140       | 9.5       | 110       | 22L      | 4.6L     | 2.4       | 120      | 42L      | 53       | 7.6       | 6.8L     | 57        | 230       | 0.8       | 67       | 11       | 29       | 87       | 91        | 31       | 12        | 4.6L      | 350       | 1.6      | 1.8      | 21        | 10L       | 7.7       | 190      | 7.8      | 67      | 5.6      | 180     | 220       |           |          |     |     |     |     |     |     |
| Guernsey                 | Londonderry | 1500         | 9.5      | 43                    | 29                                  | 1.2      | 0.71     | 0.88                   | 2.3                   | 19                                  | 1.1                   | 0.11 L                             | 1.5                  | 0.90     | 6.8L     | 540     | 240      | 33       | 10L      | 1.8       | 93        | 190       | 220       | 9.7       | 150       | 22L      | 4.6L     | 2.5       | 74       | 32L      | 65       | 4.9       | 6.8L     | 61        | 96        | 1.6       | 45       | 48       | 13       | 71       | 350       | 260      | 100L      | 310L      | 41        | 11       | 11       | 4.6L      | 350       | 1.6       | 1.8      | 21       | 10L     | 8.3      | 260     | 9.1       | 85        | 11       | 950 | 110 |     |     |     |     |
|                          | Oxford      | 1454         | 45.4     | 56                    | 26                                  | 0.57     | 1.1      | 0.59                   | 2.8                   | 4.9                                 | 2.4                   | 0.031                              | 0.98                 | 0.37     | 6.8L     | 230     | 280      | 13       | 10L      | 0.10      | 200       | 7.6       | 200       | 8.4       | 170       | 22L      | 4.6L     | 2.6       | 69       | 32L      | 23       | 9.3       | 6.8L     | 90        | 110       | 0.9       | 51       | 7.4      | 44       | 110      | 63        | 65       | 100L      | 110       | 42        | 12       | 12       | 230       | 3.6       | 2.2       | 41       | 10L      | 25      | 210      | 4.4     | 52        | 6.6       | 28       | 260 |     |     |     |     |     |
| BROOKVILLE (NO. 4) COAL  |             |              |          |                       |                                     | 1414     | 23.5     | 45                     | 26                    | 0.62                                | 0.61                  | 0.46                               | 2.0                  | 18       | 2.5      | 0.043L  | 0.22     | 0.49     | 6.8L     | 200       | 220       | 10        | 10L       | 0.16      | 150       | 18       | 210      | 6.3       | 85       | 22L      | 4.6L     | 2.5       | 70       | 32L       | 27        | 8.0       | 6.8L     | 80       | 86       | 1.0      | 43        | 14       | 30        | 85        | 98        | 65       | 100L     | 94        | 42        | 9.7       | 15       | 210      | 3.2     | 1.9      | 34      | 10L       | 13        | 190      | 4.9 | 41  | 7.1 | 32  | 150 |     |
| Belmont                  | Jefferson   | 1439         | 13.9     | 48                    | 24                                  | 0.3      | 0.60     | 0.47                   | 1.8                   | 9.3                                 | 1.4                   | 0.11                               | 3.8                  | 0.69     | 6.8L     | 520     | 1,900    | 240      | 10L      | 0.52      | 110       | 25        | 220       | 8.1       | 120       | 38       | 4.6L     | 3.1       | 130      | 32L      | 110      | 5.9       | 6.8L     | 52        | 110       | 0.4L      | 170      | 30       | 17       | 45       | 100       | 53       | 100L      | 94        | 42        | 11       | 11       | 620       | 2.0       | 1.9       | 24       | 10L      | 77      | 270      | 7.8     | 52        | 7.3       | 120      | 120 |     |     |     |     |     |
|                          | Oxford      | 1461         | 19.6     | 47                    | 23                                  | 2.3      | 1.1      | 0.69                   | 2.6                   | 15                                  | 1.4                   | 0.051L                             | 3.0                  | 0.54     | 6.8L     | 370     | 360      | 20       | 10L      | 5.6       | 120       | 26        | 150       | 12        | 120       | 22L      | 4.6L     | 2.5       | 130      | 32L      | 200      | 5.5       | 6.8L     | 53        | 140       | 0.9       | 31       | 26       | 28       | 69       | 190       | 78       | 100L      | 130       | 42        | 9.6      | 4.6L     | 290       | 2.2       | 2.3       | 23       | 10L      | 35      | 210      | 5.6     | 70        | 8.1       | 1,200    | 190 |     |     |     |     |     |
| Guernsey                 | Washington  | 1473         | 18.1     | 55                    | 28                                  | 1.3      | 0.85     | 0.45                   | 2.3                   | 5.7                                 | 1.6                   | 0.055L                             | 2.0                  | 0.63     | 6.8L     | 510     | 520      | 27       | 10L      | 1.3       | 120       | 30        | 220       | 12        | 150       | 22L      | 4.6L     | 3.6       | 130      | 32L      | 170      | 6.5       | 6.8L     | 45        | 150       | 0.5       | 89       | 36       | 27       | 110      | 290       | 85       | 100L      | 99        | 59        | 13       | 8.6      | 300       | 2.5       | 3.4       | 31       | 10L      | 59      | 340      | 5.2     | 78        | 7.8       | 450      | 180 |     |     |     |     |     |
|                          | Wills       | 1479         | 17.7     | 61                    | 28                                  | 2.0      | 0.81     | 0.47                   | 2.4                   | 8.4                                 | 1.5                   | 0.057L                             | 2.0                  | 0.45     | 6.8L     | 420     | 620      | 16       | 10L      | 0.52      | 110       | 22        | 200       | 9.8       | 63        | 22L      | 4.6L     | 2.5       | 76       | 32L      | 39       | 5.7       | 6.8L     | 47        | 150       | 0.5       | 130      | 6.2      | 40       | 70       | 100L      | 130L     | 34        | 9.4       | 9.0       | 260      | 1.0      | 2.0       | 23        | 10L       | 60       | 560      | 6.1     | 56       | 10      | 160       |           |          |     |     |     |     |     |     |
| Stark                    | Pike        | 1418         | 10.1     | 47                    | 29                                  | 3.2      | 1.2      | 0.55                   | 2.0                   | 10                                  | 0.87                  | 0.099L                             | 4.9                  | 0.84     | 6.8L     | 900     | 250      | 28       | 10L      | 2.0       | 92        | 82        | 200       | 4.9       | 79        | 22L      | 4.6L     | 3.1       | 150      | 32L      | 150      | 3.8       | 6.8L     | 31        | 56        | 0.7       | 270      | 79       | 18       | 98       | 450       | 65       | 100L      | 69        | 43        | 13       | 17       | 420       | 0.9       | 2.5       | 19       | 10L      | 100     | 310      | 11      | 82        | 8.7       | 320      | 150 |     |     |     |     |     |
|                          | Sandy       | 1434         | 9.2      | 25                    | 15                                  | 3.2      | 0.50     | 0.39                   | 0.73                  | 47                                  | 0.67                  | 0.11 L                             | 3.8                  | 1.2      | 6.8L     | 700     | 280      | 26       | 10L      | 0.92      | 63        | 44        | 170       | 3.3       | 53        | 22L      | 4.6L     | 2.2       | H        | 32L      | 210      | 3.8       | 6.8L     | 20        | 43        | 0.5       | 270      | H        | 20       | 80       | 230       | 170      | 100L      | 98L       | 36        | 9.1      | H        | 330       | 0.9       | 1.4       | 16       | 120      | 44      | 180      | 11      | 53        | 5.2       | 290      | 160 |     |     |     |     |     |
| Vinton                   | Knox        | 1424         | 8.7      | 46                    | 31                                  | 3.3      | 0.68     | 0.71                   | 1.5                   | 7.1                                 | 1.1                   | 0.11 L                             | 4.0                  | 0.70     | 6.8L     | 720     | 390      | 28       | 10L      | 0.80      | 110       | 46        | 280       | 6.4       | 130       | 22L      | 4.6L     | 2.9       | 110      | 35       | 43       | 6.7       | 7.6      | 47        | 150       | 0.9       | 99       | 46       | 25       | 140      | 200       | 68       | 100L      | 460L      | 47        | 12       | 22       | 590       | 1.4       | 3.1       | 27       | 10L      | 32      | 360      | 6.3     | 99        | 6.2       | 280      | 270 |     |     |     |     |     |
|                          | Knox        | 1424-1       | 29.2     | 42                    | 31                                  | 0.53     | 0.08     | 0.09                   | 0.45                  | 15                                  | 1.7                   | 0.034L                             | 0.83                 | 0.48     | 6.8L     | 280     | 74       | 9.4      | 10L      | 0.32      | 72        | 97        | 310       | 2.0       | 100       | 22L      | 4.6L     | 1.7       | 93       | 32L      | 6.8      | 6.8L      | 41       | 180       | 0.6       | 41        | 6.4      | 18       | 32L      | 170      | 120       | 100L     | 140L      | 47        | 6.0       | 13       | 57       | 27        | 1.2       | 33        | 10L      | 12       | 210     | 2.7      | 17      | 6.2       | 130       | 93       |     |     |     |     |     |     |
| Guernsey                 | Spencer     | 1470         | 14.3     | 54                    | 24                                  | 0.69     | 0.78     | 0.51                   | 0.28                  | 10                                  | 1.8                   | 0.070L                             | 0.85                 | 0.50     | 0.68L    | 430     | 420      | 33       | 10L      | 0.40      | 110       | 60        | 140       | 9.5       | 110       | 22L      | 4.6L     | 2.4       | 120      | 42L      | 53       | 7.6       | 6.8L     | 57        | 230       | 0.8       | 67       | 11       | 29       | 87       | 91        | 31       | 12        | 4.6L      | 350       | 1.6      | 1.8      | 21        | 10L       | 7.7       | 190      | 7.8      | 67      | 5.6      | 180     | 220       |           |          |     |     |     |     |     |     |
|                          | O           |              |          |                       |                                     |          |          |                        |                       |                                     |                       |                                    |                      |          |          |         |          |          |          |           |           |           |           |           |           |          |          |           |          |          |          |           |          |           |           |           |          |          |          |          |           |          |           |           |           |          |          |           |           |           |          |          |         |          |         |           |           |          |     |     |     |     |     |     |





